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(54) **LOCATION-AWARE MOBILE DEVICE**

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(58) **Field of Classification Search**
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See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,644,351 A 2/1987 Zabarsky et al.
4,903,212 A 2/1990 Yokouchi et al.
(Continued)

FOREIGN PATENT DOCUMENTS

BR 9904979 12/2000
CA 2163215 11/1994
(Continued)

OTHER PUBLICATIONS

"3rd Generation Partnership Project (3GPP); Technical Specification Group (TSG) RAN; Working Group 2 (WG2); Report on Location Services (LCS)," 3G TR 25.923 v. 1.0.0, Apr. 1999, 45 pages.
(Continued)

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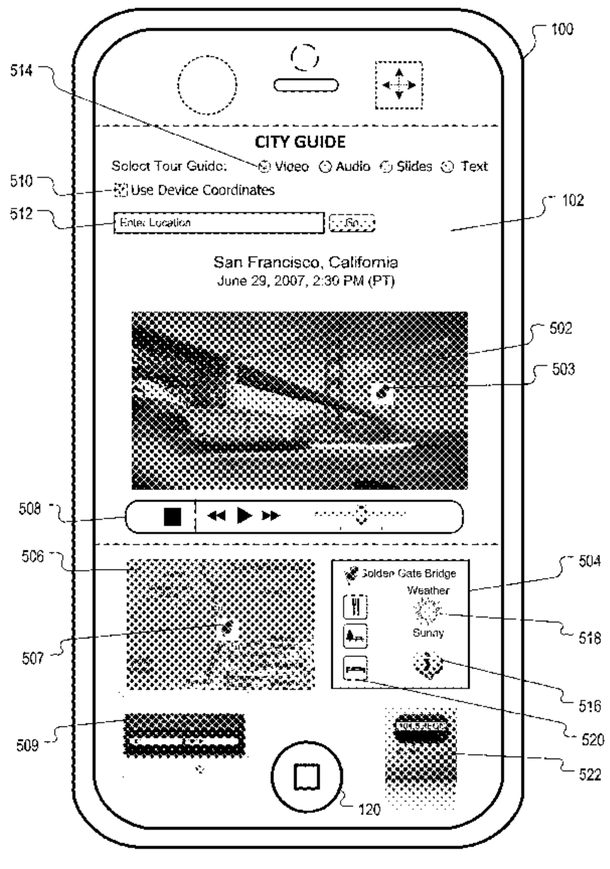
(57) **ABSTRACT**

One or more location-based clients can be activated on a mobile device for providing location-based services. The location-based clients can be provided with information (e.g., presets, defaults) related to the current location and/or mode of the mobile device. The information can be obtained from one or more network resources. In some implementations, a location-based client can concurrently display map and vehicle information related to a location of the mobile device.

23 Claims, 6 Drawing Sheets



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continuation of application No. 15/435,473, filed on Feb. 17, 2017, now Pat. No. 10,064,158, which is a continuation of application No. 15/142,343, filed on Apr. 29, 2016, now Pat. No. 9,578,621, which is a continuation of application No. 14/745,638, filed on Jun. 22, 2015, now Pat. No. 9,414,198, which is a continuation of application No. 12/163,858, filed on Jun. 27, 2008, now Pat. No. 9,066,199.

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(56) **References Cited**

U.S. PATENT DOCUMENTS

4,907,159	A	3/1990	Mauge et al.
4,999,783	A	3/1991	Tenmoku et al.
5,031,104	A	7/1991	Ikeda et al.
5,046,011	A	9/1991	Kakihara et al.
5,067,081	A	11/1991	Person
5,126,941	A	6/1992	Gurmu et al.
5,164,904	A	11/1992	Sumner
5,170,165	A	12/1992	Iihoshi et al.
5,173,691	A	12/1992	Sumner
5,182,555	A	1/1993	Sumner
5,187,810	A	2/1993	Yoneyama et al.
5,195,031	A	3/1993	Ordish
5,208,763	A	5/1993	Hong et al.
5,218,629	A	6/1993	Dumond, Jr. et al.
5,243,652	A	9/1993	Teare et al.
5,274,560	A	12/1993	LaRue
5,289,572	A	2/1994	Yano et al.
5,295,064	A	3/1994	Malec et al.
5,307,278	A	4/1994	Hermans et al.
5,317,311	A	5/1994	Martell et al.
5,337,044	A	8/1994	Folger et al.
5,339,391	A	8/1994	Wroblewski et al.
5,371,678	A	12/1994	Nomura
5,374,933	A	12/1994	Kao
5,379,057	A	1/1995	Clough et al.
5,390,125	A	2/1995	Sennott et al.
5,406,490	A	4/1995	Braegas
5,416,712	A	5/1995	Geier et al.
5,416,890	A	5/1995	Beretta
5,440,484	A	8/1995	Kao
5,463,725	A	10/1995	Henckel
5,469,362	A	11/1995	Hunt et al.
5,479,600	A	12/1995	Wroblewski et al.
5,504,482	A	4/1996	Schreder
5,508,707	A	4/1996	LeBlanc et al.
5,510,801	A	4/1996	Engelbrecht et al.
5,519,760	A	5/1996	Borkowski et al.
5,523,950	A	6/1996	Peterson
5,537,460	A	7/1996	Holliday, Jr. et al.
5,539,395	A	7/1996	Buss et al.
5,539,647	A	7/1996	Shibata et al.
5,552,989	A	9/1996	Bertrand
5,559,520	A	9/1996	Barzegar et al.
5,570,412	A	10/1996	LeBlanc
5,598,572	A	1/1997	Tanikoshi et al.
5,627,547	A	5/1997	Ramaswamy et al.
5,627,549	A	5/1997	Park
5,628,050	A	5/1997	McGraw et al.
5,630,206	A	5/1997	Urban et al.
5,636,245	A	6/1997	Ernst et al.
5,642,303	A	6/1997	Small et al.
5,646,853	A	7/1997	Takahashi et al.
5,654,908	A	8/1997	Yokoyama
5,663,732	A	9/1997	Stangeland et al.
5,675,362	A	10/1997	Clough et al.
5,675,573	A	10/1997	Karol et al.
5,677,837	A	10/1997	Reynolds
5,684,859	A	11/1997	Chanroo et al.
5,689,252	A	11/1997	Ayanoglu et al.
5,689,269	A	11/1997	Norris
5,689,270	A	11/1997	Kelley et al.
5,689,431	A	11/1997	Rudow et al.
5,708,478	A	1/1998	Tognazzini
5,717,392	A	2/1998	Eldridge
5,727,057	A	3/1998	Emery et al.
5,732,074	A	3/1998	Spaur et al.
5,742,666	A	4/1998	Alpert
5,745,865	A	4/1998	Rostoker et al.
5,748,109	A	5/1998	Kosaka et al.
5,748,148	A	5/1998	Heiser et al.
5,752,186	A	5/1998	Malackowski et al.
5,754,430	A	5/1998	Sawada
5,758,049	A	5/1998	Johnson et al.
5,760,773	A	6/1998	Berman et al.
5,767,795	A	6/1998	Schaphorst
5,771,280	A	6/1998	Johnson
5,774,824	A	6/1998	Streit et al.
5,774,829	A	6/1998	Cisneros et al.
5,793,630	A	8/1998	Theimer et al.
5,796,365	A	8/1998	Lewis et al.
5,796,613	A	8/1998	Kato et al.
5,799,061	A	8/1998	Melcher et al.
5,806,018	A	9/1998	Smith et al.
5,825,306	A	10/1998	Hiyokawa et al.
5,825,884	A	10/1998	Zdepski et al.
5,831,552	A	11/1998	Sogawa et al.
5,835,061	A	11/1998	Stewart
5,839,086	A	11/1998	Hirano
5,845,227	A	12/1998	Peterson
5,848,373	A	12/1998	DeLorme et al.
5,862,244	A	1/1999	Kleiner et al.
5,867,110	A	2/1999	Naito et al.
5,870,686	A	2/1999	Monson
5,872,526	A	2/1999	Tognazzini
5,873,068	A	2/1999	Beaumont et al.
5,883,580	A	3/1999	Briancon et al.
5,887,269	A	3/1999	Brunts et al.
5,892,454	A	4/1999	Schipper et al.
5,893,898	A	4/1999	Tanimoto
5,898,680	A	4/1999	Johnstone et al.
5,899,954	A	5/1999	Sato
5,905,451	A	5/1999	Sakashita
5,908,465	A	6/1999	Ito et al.
5,910,799	A	6/1999	Carpenter et al.
5,923,861	A	7/1999	Bertram et al.
5,933,094	A	8/1999	Goss et al.
5,933,100	A	8/1999	Golding
5,936,572	A	8/1999	Loomis et al.
5,938,721	A	8/1999	Dussell et al.
5,941,930	A	8/1999	Morimoto et al.
5,941,934	A	8/1999	Sato
5,946,618	A	8/1999	Agre et al.
5,948,040	A	9/1999	DeLorme et al.
5,948,041	A	9/1999	Abo et al.
5,948,061	A	9/1999	Merriman et al.
5,955,973	A	9/1999	Anderson
5,959,577	A	9/1999	Fan et al.
5,959,580	A	9/1999	Maloney et al.
5,968,109	A	10/1999	Israni et al.
5,969,678	A	10/1999	Stewart

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,982,298	A	11/1999	Lappenbusch et al.
5,982,324	A	11/1999	Watters et al.
5,987,381	A	11/1999	Oshizawa
5,991,692	A	11/1999	Spencer, II et al.
5,999,126	A	12/1999	Ito
6,002,932	A	12/1999	Kingdon et al.
6,002,936	A	12/1999	Roel-Ng et al.
6,005,928	A	12/1999	Johnson
6,014,090	A	1/2000	Rosen et al.
6,014,607	A	1/2000	Yagyu et al.
6,018,697	A	1/2000	Morimoto et al.
6,023,653	A	2/2000	Ichimura et al.
6,026,375	A	2/2000	Hall et al.
6,028,550	A	2/2000	Froeberg et al.
6,029,069	A	2/2000	Takaki
6,031,490	A	2/2000	Forssen et al.
6,041,280	A	3/2000	Kohli et al.
6,052,645	A	4/2000	Harada
6,058,350	A	5/2000	Ihara
6,064,335	A	5/2000	Eschenbach
6,067,502	A	5/2000	Hayashida et al.
6,069,570	A	5/2000	Herring
6,073,013	A	6/2000	Agre et al.
6,073,062	A	6/2000	Hoshino et al.
6,076,041	A	6/2000	Watanabe
6,078,818	A	6/2000	Kingdon et al.
6,081,206	A	6/2000	Kielland
6,085,090	A	7/2000	Yee et al.
6,085,148	A	7/2000	Jamison et al.
6,087,965	A	7/2000	Murphy
6,088,594	A	7/2000	Kingdon et al.
6,091,956	A	7/2000	Hollenberg
6,091,957	A	7/2000	Larkins et al.
6,092,076	A	7/2000	McDonough et al.
6,094,607	A	7/2000	Diesel
6,101,443	A	8/2000	Kato et al.
6,104,931	A	8/2000	Havinis et al.
6,108,555	A	8/2000	Maloney et al.
6,111,541	A	8/2000	Karmel
6,115,611	A	9/2000	Kimoto et al.
6,115,754	A	9/2000	Landgren
6,119,014	A	9/2000	Alperovich et al.
6,122,520	A	9/2000	Want et al.
6,125,279	A	9/2000	Hyziak et al.
6,127,945	A	10/2000	Mura-Smith
6,128,482	A	10/2000	Nixon et al.
6,128,571	A	10/2000	Ito et al.
6,134,548	A	10/2000	Gottsman et al.
6,138,003	A	10/2000	Kingdon et al.
6,138,142	A	10/2000	Linsk
6,140,957	A	10/2000	Wilson et al.
6,151,309	A	11/2000	Busuioc et al.
6,151,498	A	11/2000	Roel-Ng et al.
6,154,152	A	11/2000	Ito
6,157,381	A	12/2000	Bates et al.
6,157,841	A	12/2000	Bolduc et al.
6,163,749	A	12/2000	McDonough et al.
6,166,627	A	12/2000	Reeley
6,167,266	A	12/2000	Havinis et al.
6,169,552	B1	1/2001	Endo et al.
6,175,740	B1	1/2001	Souissi et al.
6,177,905	B1	1/2001	Welch
6,177,938	B1	1/2001	Gould
6,181,934	B1	1/2001	Havinis et al.
6,185,427	B1	2/2001	Krasner et al.
6,188,959	B1	2/2001	Schupfner
6,195,557	B1	2/2001	Havinis et al.
6,195,609	B1	2/2001	Pilley et al.
6,199,014	B1	3/2001	Walker et al.
6,199,045	B1	3/2001	Giniger et al.
6,199,099	B1	3/2001	Gershman et al.
6,202,008	B1	3/2001	Beckert et al.
6,202,023	B1	3/2001	Hancock et al.
6,208,866	B1	3/2001	Rouhollahzadeh et al.
6,212,473	B1	4/2001	Stefan et al.
6,216,086	B1	4/2001	Seymour et al.
6,222,483	B1	4/2001	Twitchell et al.
6,233,518	B1	5/2001	Lee
6,236,365	B1	5/2001	LeBlanc et al.
6,236,933	B1	5/2001	Lang
6,246,948	B1	6/2001	Thakker
6,249,252	B1	6/2001	Dupray
6,252,543	B1	6/2001	Camp
6,252,544	B1	6/2001	Hoffberg
6,256,498	B1	7/2001	Ludwig
6,259,405	B1	7/2001	Stewart et al.
6,266,612	B1	7/2001	Dussell et al.
6,266,614	B1	7/2001	Alumbaugh
6,266,615	B1	7/2001	Jin
6,272,342	B1	8/2001	Havinis et al.
6,278,884	B1	8/2001	Kim
6,281,807	B1	8/2001	Kynast et al.
6,282,491	B1	8/2001	Bochmann et al.
6,282,496	B1	8/2001	Chowdhary
6,295,454	B1	9/2001	Havinis et al.
6,298,306	B1	10/2001	Suarez et al.
6,304,758	B1	10/2001	Iierbig et al.
6,313,761	B1	11/2001	Shinada
6,314,369	B1	11/2001	Ito et al.
6,314,406	B1	11/2001	O'Hagan et al.
6,317,684	B1	11/2001	Roeseler et al.
6,321,158	B1	11/2001	DeLorme et al.
6,323,846	B1	11/2001	Westerman et al.
6,324,692	B1	11/2001	Fiske
6,326,918	B1	12/2001	Stewart
6,332,127	B1	12/2001	Bandera et al.
6,334,090	B1	12/2001	Fujii
6,339,437	B1	1/2002	Nielsen
6,339,746	B1	1/2002	Sugiyama et al.
6,343,317	B1	1/2002	Glorikian
6,345,288	B1	2/2002	Reed et al.
6,351,235	B1	2/2002	Stilp
6,353,398	B1	3/2002	Amin et al.
6,353,406	B1	3/2002	Lanzl et al.
6,353,743	B1	3/2002	Karmel
6,353,837	B1	3/2002	Blumenau
6,356,761	B1	3/2002	Huttunen et al.
6,356,763	B1	3/2002	Kangas et al.
6,356,836	B1	3/2002	Adolph
6,356,838	B1	3/2002	Paul
6,370,629	B1	4/2002	Hastings et al.
6,377,810	B1	4/2002	Geiger et al.
6,377,886	B1	4/2002	Gotou
6,381,465	B1	4/2002	Chern et al.
6,381,539	B1	4/2002	Shimazu
6,381,603	B1	4/2002	Chan et al.
6,385,458	B1	5/2002	Papadimitriou et al.
6,385,465	B1	5/2002	Yoshioka
6,385,535	B2	5/2002	Ohishi et al.
6,389,288	B1	5/2002	Kuwahara et al.
6,401,027	B1	6/2002	Xu et al.
6,401,032	B1	6/2002	Jamison et al.
6,405,034	B1	6/2002	Tijerino
6,405,123	B1	6/2002	Rennard et al.
6,411,899	B2	6/2002	Dussell et al.
6,414,635	B1	7/2002	Stewart et al.
6,415,207	B1	7/2002	Jones
6,415,220	B1	7/2002	Kovacs
6,415,227	B1	7/2002	Lin
6,427,115	B1	7/2002	Sekiyama
6,430,411	B1	8/2002	Lempio et al.
6,434,530	B1	8/2002	Sloane et al.
6,438,490	B2	8/2002	Ohta
6,446,004	B1	9/2002	Cao et al.
6,449,485	B1	9/2002	Anzil
6,452,498	B2	9/2002	Stewart
6,456,234	B1	9/2002	Johnson
6,456,956	B1	9/2002	Xiong
6,459,782	B1	10/2002	Bedrosian et al.
6,463,289	B1	10/2002	Havinis et al.
6,477,581	B1	11/2002	Carpenter et al.
6,487,305	B2	11/2002	Kambe et al.
6,490,454	B1	12/2002	Kangas et al.
6,490,519	B1	12/2002	Lapidot et al.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,501,421	B1	12/2002	Dutta et al.
6,502,033	B1	12/2002	Phuyal
6,505,046	B1	1/2003	Baker
6,505,048	B1	1/2003	Moles et al.
6,505,123	B1	1/2003	Root et al.
6,507,802	B1	1/2003	Payton et al.
6,516,197	B2	2/2003	Havinis et al.
6,519,463	B2	2/2003	Tendler
6,519,571	B1	2/2003	Guheen et al.
6,526,335	B1	2/2003	Treyz et al.
6,529,143	B2	3/2003	Mikkola et al.
6,535,140	B1	3/2003	Goss et al.
6,542,812	B1	4/2003	Obradovich et al.
6,542,819	B1	4/2003	Kovacs et al.
6,545,638	B2	4/2003	Sladen
6,546,336	B1	4/2003	Matsuoka et al.
6,546,360	B1	4/2003	Gilbert et al.
6,552,682	B1	4/2003	Fan
6,563,430	B1	5/2003	Kemink et al.
6,564,143	B1	5/2003	Alewine et al.
6,570,557	B1	5/2003	Westerman et al.
6,571,279	B1	5/2003	Herz et al.
6,574,484	B1	6/2003	Carley
6,574,550	B2	6/2003	Hashida
6,587,688	B1	7/2003	Chambers et al.
6,587,782	B1	7/2003	Nocek et al.
6,587,835	B1	7/2003	Treyz et al.
6,594,480	B1	7/2003	Montalvo et al.
6,597,305	B2	7/2003	Szeto et al.
6,611,687	B1	8/2003	Clark et al.
6,611,788	B1	8/2003	Hussa
6,615,131	B1	9/2003	Rennard et al.
6,615,213	B1	9/2003	Johnson
6,643,587	B2	11/2003	Brodie et al.
6,647,257	B2	11/2003	Owensby
6,650,902	B1	11/2003	Richton
6,650,997	B2	11/2003	Funk
6,662,016	B1	12/2003	Buckham et al.
6,662,023	B1	12/2003	Helle
6,667,963	B1	12/2003	Rantalainen et al.
6,671,377	B1	12/2003	Havinis et al.
6,674,849	B1	1/2004	Froeberg
6,677,894	B2	1/2004	Sheynblat et al.
6,678,516	B2	1/2004	Nordman et al.
6,679,932	B2	1/2004	Birler et al.
6,680,694	B1	1/2004	Knockeart et al.
6,681,120	B1	1/2004	Kim
6,683,538	B1	1/2004	Wilkes, Jr.
6,697,018	B2	2/2004	Stewart
6,697,734	B1	2/2004	Suomela
6,711,408	B1	3/2004	Raith
6,711,474	B1	3/2004	Treyz et al.
6,714,791	B2	3/2004	Friedman
6,718,344	B2	4/2004	Hirono
6,721,572	B1	4/2004	Smith et al.
6,731,236	B1	5/2004	Hager et al.
6,731,238	B2	5/2004	Johnson
6,732,047	B1	5/2004	de Silva
6,738,808	B1	5/2004	Zellner et al.
6,741,188	B1	5/2004	Miller et al.
6,741,926	B1	5/2004	Zhao et al.
6,748,226	B1	6/2004	Wortham
6,748,318	B1	6/2004	Jones
6,750,883	B1	6/2004	Parupudi et al.
6,759,960	B2	7/2004	Stewart
6,762,772	B1	7/2004	Imamura et al.
6,766,174	B1	7/2004	Kenyon
6,766,245	B2	7/2004	Padmanabhan
6,781,575	B1	8/2004	Hawkins et al.
6,782,278	B2	8/2004	Chen et al.
6,789,012	B1	9/2004	Childs et al.
6,795,686	B2	9/2004	Master et al.
6,801,855	B1	10/2004	Walters et al.
6,810,323	B1	10/2004	Bullock et al.
6,813,501	B2	11/2004	Kinnunen et al.
6,813,503	B1	11/2004	Zillikens et al.
6,813,582	B2	11/2004	Levi et al.
6,816,782	B1	11/2004	Walters et al.
6,819,919	B1	11/2004	Tanaka
6,823,188	B1	11/2004	Stern
6,834,195	B2	12/2004	Brandenberg et al.
6,845,318	B1	1/2005	Moore et al.
6,847,891	B2	1/2005	Pietras et al.
6,847,969	B1	1/2005	Mathai et al.
6,853,911	B1	2/2005	Sakarya
6,853,917	B2	2/2005	Miwa
6,859,149	B1	2/2005	Ohta
6,865,483	B1	3/2005	Cook, III et al.
6,868,074	B1	3/2005	Hanson
6,871,144	B1	3/2005	Lee
6,879,838	B2	4/2005	Rankin et al.
6,882,313	B1	4/2005	Fan et al.
6,888,536	B2	5/2005	Westerman et al.
6,909,902	B1	6/2005	Sawada et al.
6,912,398	B1	6/2005	Domnitz
6,914,626	B2	7/2005	Squibbs
6,915,208	B2	7/2005	Garin et al.
6,931,322	B2	8/2005	Jung et al.
6,933,841	B2	8/2005	Muramatsu et al.
6,941,222	B2	9/2005	Yano et al.
6,944,447	B2	9/2005	Portman et al.
6,948,656	B2	9/2005	Williams
6,950,746	B2	9/2005	Yano et al.
6,952,181	B2	10/2005	Karr et al.
6,954,646	B2	10/2005	Churt
6,954,735	B1	10/2005	Djupsjobacka et al.
6,957,072	B2	10/2005	Kangras et al.
6,975,959	B2	12/2005	Dietrich et al.
6,980,909	B2	12/2005	Root et al.
6,990,495	B1	1/2006	Grason et al.
6,999,779	B1	2/2006	Hashimoto
7,003,289	B1	2/2006	Kolls
7,009,556	B2	3/2006	Stewart
7,031,725	B2	4/2006	Rorabaugh
7,044,372	B2	5/2006	Okuda et al.
7,058,594	B2	6/2006	Stewart
7,069,319	B2	6/2006	Zellner et al.
7,076,255	B2	7/2006	Parupudi et al.
7,082,365	B2	7/2006	Sheha et al.
7,089,264	B1	8/2006	Guido et al.
7,096,029	B1	8/2006	Parupudi et al.
7,096,030	B2	8/2006	Huomo
7,103,470	B2	9/2006	Mintz
7,103,472	B2	9/2006	Itabashi
7,117,015	B2	10/2006	Scheinert et al.
7,120,469	B1	10/2006	Urakawa
7,123,189	B2	10/2006	Lalik et al.
7,123,926	B2	10/2006	Himmelstein
7,130,630	B1	10/2006	Enzmann et al.
7,130,743	B2	10/2006	Kudo et al.
7,136,853	B1	11/2006	Kohda et al.
7,146,298	B2	12/2006	Motamedi et al.
7,149,503	B2	12/2006	Aarnio et al.
7,151,921	B2	12/2006	Otsuka
7,165,725	B2	1/2007	Casey
7,171,190	B2	1/2007	Ye et al.
7,181,189	B2	2/2007	Hotta et al.
7,187,997	B2	3/2007	Johnson
7,200,409	B1	4/2007	Ichikawa et al.
7,200,566	B1	4/2007	Moore et al.
7,213,048	B1	5/2007	Parupudi et al.
7,215,967	B1	5/2007	Kransmo et al.
7,222,293	B1	5/2007	Zapiec et al.
7,236,883	B2	6/2007	Garin et al.
7,254,481	B2	8/2007	Yamada et al.
7,256,711	B2	8/2007	Sheha et al.
7,257,392	B2	8/2007	Tang et al.
7,260,378	B2	8/2007	Holland et al.
7,266,376	B2	9/2007	Nakagawa
7,269,601	B2	9/2007	Kinno et al.
7,271,765	B2	9/2007	Stilp et al.
7,272,403	B2	9/2007	Creamer et al.
7,272,404	B2	9/2007	Overy et al.
7,274,332	B1	9/2007	Dupray

(56) **References Cited**

U.S. PATENT DOCUMENTS

7,274,939	B2	9/2007	Ruutu et al.	
7,280,822	B2	10/2007	Fraccaroli	
7,286,933	B2	10/2007	Cho	
7,295,556	B2	11/2007	Roese et al.	
7,295,925	B2	11/2007	Breed et al.	
7,298,327	B2	11/2007	Dupray et al.	
7,299,008	B2	11/2007	Gluck	
7,310,516	B1	12/2007	Vacanti et al.	
7,313,405	B2	12/2007	Tanabe	
7,313,467	B2	12/2007	Breed et al.	
7,319,412	B1	1/2008	Coppinger et al.	
7,336,928	B2	2/2008	Paalasmaa et al.	
7,336,949	B2	2/2008	Nasielski	
7,339,496	B2	3/2008	Endo et al.	
7,343,564	B2	3/2008	Othmer	
7,349,706	B2	3/2008	Kim et al.	
7,353,034	B2	4/2008	Haney	
7,359,713	B1	4/2008	Tiwari	
7,370,283	B2	5/2008	Othmer	
7,373,246	B2	5/2008	O'Clair	
7,386,396	B2	6/2008	Johnson	
7,389,179	B2	6/2008	Jin et al.	
7,392,017	B2	6/2008	Chu et al.	
7,395,031	B1	7/2008	Ritter	
7,418,402	B2	8/2008	McCrossin et al.	
7,421,422	B1	9/2008	Dempster et al.	
7,421,486	B1	9/2008	Parupudi et al.	
7,426,437	B2	9/2008	Breed et al.	
7,427,021	B2	9/2008	Kemper et al.	
7,433,694	B2	10/2008	Morgan et al.	
7,440,842	B1	10/2008	Vorona	
7,441,203	B2	10/2008	Othmer et al.	
7,466,235	B1	12/2008	Kolb et al.	
7,483,944	B2	1/2009	Parupudi et al.	
7,486,201	B2	2/2009	Kelly et al.	
7,496,444	B1	2/2009	Fried et al.	
7,500,607	B2	3/2009	Williams	
7,512,487	B1	3/2009	Golding et al.	
7,522,927	B2	4/2009	Fitch et al.	
7,525,484	B2	4/2009	Dupray et al.	
7,536,388	B2	5/2009	Jung et al.	
7,545,281	B2	6/2009	Richards et al.	
7,558,696	B2	7/2009	Vilppula et al.	
7,565,132	B2	7/2009	Ben Ayed	
7,565,157	B1	7/2009	Ortega et al.	
7,574,222	B2	8/2009	Sawada et al.	
7,577,448	B2	8/2009	Pande et al.	
7,587,345	B2	9/2009	Mann et al.	
7,593,740	B2	9/2009	Crowley et al.	
7,593,991	B2	9/2009	Friedman et al.	
7,596,450	B2	9/2009	Hong	
7,599,795	B1	10/2009	Blumberg et al.	
7,603,233	B2	10/2009	Tashiro	
7,606,580	B2	10/2009	Granito et al.	
7,617,044	B2	11/2009	Lee	
7,620,404	B2	11/2009	Chesnais et al.	
7,623,848	B2	11/2009	Rosenfelt et al.	
7,624,358	B2	11/2009	Kim et al.	
7,647,174	B2	1/2010	Kwon	
7,680,591	B2	3/2010	Nagata et al.	
7,683,893	B2	3/2010	Kim et al.	
7,689,916	B1	3/2010	Goel et al.	
7,710,290	B2	5/2010	Johnson	
7,711,478	B2	5/2010	Gluck	
7,714,778	B2	5/2010	Dupray	
7,729,691	B2	6/2010	Newville	
7,739,040	B2	6/2010	Horvitz	
7,742,774	B2	6/2010	Oh et al.	
7,743,074	B1	6/2010	Parupudi et al.	
7,756,639	B2	7/2010	Colley et al.	
7,768,395	B2	8/2010	Gold	
7,783,421	B2	8/2010	Arai et al.	
7,792,273	B2	9/2010	Fano et al.	
7,811,203	B2	10/2010	Unuma et al.	
7,817,033	B2	10/2010	Motoyama	
7,818,116	B1 *	10/2010	Nesbitt	G01C 21/367 340/955
7,822,547	B2	10/2010	Lindroos	
7,840,347	B2	11/2010	Noguchi	
7,848,388	B2	12/2010	Tudosoiu	
7,848,765	B2	12/2010	Phillips et al.	
7,860,758	B2	12/2010	McCrossin et al.	
7,890,089	B1	2/2011	Fujisaki	
7,890,123	B2	2/2011	Granito et al.	
7,929,010	B2	4/2011	Narasimhan	
7,933,612	B2	4/2011	Counts et al.	
7,933,929	B1	4/2011	McClendon et al.	
7,941,188	B2	5/2011	Jung et al.	
7,962,280	B2	6/2011	Kindo et al.	
7,970,418	B2	6/2011	Schmidt et al.	
7,979,350	B1	7/2011	Carion	
7,991,432	B2	8/2011	Silverbrook et al.	
8,031,050	B2	10/2011	Johnson	
8,036,630	B2	10/2011	Park et al.	
8,036,634	B2	10/2011	DiMeo et al.	
8,046,009	B2	10/2011	Bodmer et al.	
RE42,927	E	11/2011	Want et al.	
8,073,565	B2	12/2011	Johnson	
8,082,094	B2	12/2011	Gao	
8,095,152	B2	1/2012	Sheha et al.	
8,108,144	B2	1/2012	Forstall et al.	
8,229,458	B2	7/2012	Busch	
8,250,634	B2	8/2012	Agarwal et al.	
8,332,878	B2	12/2012	Harm	
8,380,982	B2	2/2013	Miyabayashi et al.	
8,385,943	B1	2/2013	Han et al.	
8,385,946	B2	2/2013	Forstall et al.	
8,386,655	B2	2/2013	Luers	
8,478,307	B1	7/2013	Hayes	
8,489,121	B2	7/2013	Liang	
8,538,685	B2	9/2013	Johnson	
8,639,267	B2	1/2014	Johnson	
8,762,056	B2	6/2014	Forstall et al.	
8,774,825	B2	7/2014	Forstall et al.	
8,963,686	B2	2/2015	Johnson	
9,066,199	B2	6/2015	Forstall et al.	
9,100,793	B2	8/2015	Johnson	
9,109,904	B2	8/2015	Forstall et al.	
9,250,092	B2	2/2016	Blumenberg et al.	
9,310,206	B2	4/2016	Forstall et al.	
9,317,867	B2	4/2016	Johnson	
9,414,198	B2	8/2016	Forstall et al.	
9,578,621	B2	7/2017	Forstall et al.	
2001/0018349	A1	8/2001	Kinnunen et al.	
2001/0043148	A1	11/2001	Stewart	
2001/0046884	A1	11/2001	Yoshioka	
2002/0026289	A1	2/2002	Kuzunuki et al.	
2002/0030698	A1	3/2002	Baur et al.	
2002/0032035	A1	3/2002	Teshima	
2002/0035493	A1	3/2002	Mozayeny et al.	
2002/0035609	A1	3/2002	Lessard et al.	
2002/0042266	A1	4/2002	Heyward et al.	
2002/0046069	A1	4/2002	Mozayeny et al.	
2002/0046077	A1	4/2002	Mozayeny et al.	
2002/0046084	A1	4/2002	Steele et al.	
2002/0055373	A1	5/2002	King et al.	
2002/0067353	A1	6/2002	Kenyon et al.	
2002/0077144	A1	6/2002	Keller et al.	
2002/0087505	A1	7/2002	Smith et al.	
2002/0091632	A1	7/2002	Turock et al.	
2002/0091991	A1	7/2002	Castro	
2002/0095486	A1	7/2002	Bahl	
2002/0098849	A1	7/2002	Bloebaum et al.	
2002/0118112	A1	8/2002	Lang	
2002/0126146	A1	9/2002	Burns et al.	
2002/0128773	A1	9/2002	Chowanic et al.	
2002/0132625	A1	9/2002	Ogino et al.	
2002/0140560	A1	10/2002	Altman et al.	
2002/0160815	A1	10/2002	Patel et al.	
2002/0164999	A1	11/2002	Johnson	
2002/0167442	A1	11/2002	Taylor	
2002/0173905	A1	11/2002	Jin et al.	
2002/0183927	A1	12/2002	Odamura	
2003/0001827	A1	1/2003	Gould	

(56) **References Cited**

U.S. PATENT DOCUMENTS

2003/0006914 A1 1/2003 Todoriki et al.
2003/0008662 A1 1/2003 Stern et al.
2003/0014181 A1 1/2003 Myr
2003/0016804 A1 1/2003 Sheha et al.
2003/0032404 A1 2/2003 Wager et al.
2003/0055560 A1 3/2003 Phillips
2003/0060211 A1 3/2003 Chern et al.
2003/0060212 A1 3/2003 Thomas
2003/0060215 A1 3/2003 Graham
2003/0060973 A1 3/2003 Mathews et al.
2003/0060976 A1 3/2003 Sato et al.
2003/0065934 A1 4/2003 Angelo et al.
2003/0069029 A1 4/2003 Dowling et al.
2003/0069683 A1 4/2003 Lapidot et al.
2003/0078054 A1 4/2003 Okuda
2003/0078055 A1 4/2003 Smith et al.
2003/0078057 A1 4/2003 Watanabe et al.
2003/0093217 A1 5/2003 Petzold et al.
2003/0096620 A1 5/2003 Ozturk et al.
2003/0100326 A1 5/2003 Grube et al.
2003/0100334 A1 5/2003 Mazzara, Jr.
2003/0101225 A1 5/2003 Han et al.
2003/0105826 A1 6/2003 Mayraz
2003/0120423 A1 6/2003 Cochlovius et al.
2003/0134657 A1 7/2003 Norta et al.
2003/0139150 A1 7/2003 Rodriguez et al.
2003/0140136 A1 7/2003 Nakamura
2003/0144793 A1 7/2003 Melaku et al.
2003/0148774 A1 8/2003 Naghian et al.
2003/0158655 A1 8/2003 Obradovich et al.
2003/0191578 A1 10/2003 Paulauskas et al.
2003/0229446 A1 12/2003 Boscamp et al.
2003/0236106 A1 12/2003 Master et al.
2004/0010358 A1 1/2004 Oesterling et al.
2004/0019582 A1 1/2004 Brown
2004/0036649 A1 2/2004 Taylor
2004/0054428 A1 3/2004 Sheha et al.
2004/0059502 A1 3/2004 Levi et al.
2004/0068439 A1 4/2004 Elgrably
2004/0068634 A1 4/2004 Otsuka
2004/0072557 A1 4/2004 Paila et al.
2004/0072577 A1 4/2004 Myllymaki et al.
2004/0073361 A1 4/2004 Tzamaloukas et al.
2004/0082351 A1 4/2004 Westman
2004/0083050 A1 4/2004 Biyani
2004/0093155 A1 5/2004 Simonds
2004/0093392 A1 5/2004 Nagamatsu et al.
2004/0093566 A1 5/2004 McElligott
2004/0098175 A1 5/2004 Said et al.
2004/0104842 A1 6/2004 Drury et al.
2004/0110488 A1 6/2004 Komsi
2004/0110515 A1 6/2004 Blumberg et al.
2004/0128066 A1 7/2004 Kudo et al.
2004/0128067 A1 7/2004 Smith
2004/0137893 A1 7/2004 Muthuswamy et al.
2004/0151151 A1 8/2004 Kubler et al.
2004/0158401 A1 8/2004 Yoon
2004/0158584 A1 8/2004 Necsoiu et al.
2004/0172409 A1 9/2004 James
2004/0176907 A1 9/2004 Nesbitt
2004/0180669 A1 9/2004 Kall
2004/0192299 A1 9/2004 Wilson et al.
2004/0192351 A1 9/2004 Duncan
2004/0198335 A1 10/2004 Campen
2004/0198379 A1 10/2004 Magee et al.
2004/0198397 A1 10/2004 Weiss
2004/0203569 A1 10/2004 Jijina et al.
2004/0203746 A1 10/2004 Knauerhase et al.
2004/0203836 A1 10/2004 Gorday et al.
2004/0203880 A1 10/2004 Riley
2004/0203909 A1 10/2004 Koster
2004/0204842 A1 10/2004 Shinozaki
2004/0215707 A1 10/2004 Fujita et al.
2004/0225436 A1 11/2004 Yoshihashi
2004/0228330 A1 11/2004 Kubler et al.
2004/0236504 A1 11/2004 Bickford et al.
2004/0242149 A1 12/2004 Luneau
2004/0246940 A1 12/2004 Kubler et al.
2004/0248586 A1 12/2004 Patel et al.
2004/0260457 A1 12/2004 Kawase et al.
2004/0260939 A1 12/2004 Ichikawa et al.
2004/0263084 A1 12/2004 Mor et al.
2004/0264442 A1 12/2004 Kubler et al.
2005/0002419 A1 1/2005 Doviak et al.
2005/0004838 A1 1/2005 Perkowski et al.
2005/0009511 A1 1/2005 Bostrom et al.
2005/0020223 A1 1/2005 Ellis et al.
2005/0020315 A1 1/2005 Robertson et al.
2005/0027442 A1 2/2005 Kelley et al.
2005/0033509 A1 2/2005 Clapper
2005/0033515 A1 2/2005 Bozzone
2005/0037781 A1 2/2005 Ozugur et al.
2005/0039140 A1 2/2005 Chen
2005/0046584 A1 3/2005 Breed
2005/0071078 A1 3/2005 Yamada et al.
2005/0071702 A1 3/2005 Morisawa
2005/0073443 A1 4/2005 Sheha et al.
2005/0075116 A1 4/2005 Laird
2005/0085272 A1 4/2005 Anderson et al.
2005/0091408 A1 4/2005 Parupudi et al.
2005/0096840 A1 5/2005 Simske
2005/0114021 A1 5/2005 Krull et al.
2005/0130677 A1 6/2005 Meunier et al.
2005/0134440 A1 6/2005 Breed
2005/0134578 A1 6/2005 Chambers et al.
2005/0149250 A1 7/2005 Isaac
2005/0153681 A1 7/2005 Hanson
2005/0176411 A1 8/2005 Taya
2005/0186954 A1 8/2005 Kenney
2005/0190789 A1 9/2005 Salkini et al.
2005/0192025 A1 9/2005 Kaplan
2005/0197767 A1 9/2005 Nortrup
2005/0203698 A1 9/2005 Lee
2005/0216184 A1 9/2005 Ehlers
2005/0221799 A1 10/2005 Tervo et al.
2005/0221808 A1 10/2005 Karlsson et al.
2005/0221843 A1 10/2005 Friedman et al.
2005/0222756 A1 10/2005 Davis et al.
2005/0222763 A1 10/2005 Uyeki
2005/0227709 A1 10/2005 Chang et al.
2005/0228553 A1 10/2005 Tryon
2005/0228860 A1 10/2005 Hamynen et al.
2005/0234637 A1 10/2005 Obradovich et al.
2005/0239477 A1 10/2005 Kim et al.
2005/0250440 A1 11/2005 Zhou et al.
2005/0256639 A1 11/2005 Aleksic et al.
2005/0267676 A1 12/2005 Nezu et al.
2005/0272473 A1 12/2005 Sheena et al.
2005/0286421 A1 12/2005 Janacek
2006/0009908 A1 1/2006 Tomita et al.
2006/0015249 A1 1/2006 Gieseke
2006/0022048 A1 2/2006 Johnson
2006/0025158 A1 2/2006 Leblanc et al.
2006/0026536 A1 2/2006 Hotelling et al.
2006/0029109 A1 2/2006 Moran
2006/0038719 A1 2/2006 Pande et al.
2006/0041374 A1 2/2006 Inoue
2006/0041377 A1 2/2006 Jung et al.
2006/0041378 A1 2/2006 Cheng et al.
2006/0056388 A1 3/2006 Livingwood
2006/0058955 A1 3/2006 Mehren
2006/0063539 A1 3/2006 Beyer, Jr.
2006/0064239 A1 3/2006 Ishii
2006/0068809 A1 3/2006 Wengler et al.
2006/0069503 A1 3/2006 Suomela
2006/0072542 A1 4/2006 Sinnreich et al.
2006/0084414 A1 4/2006 Alberth, Jr. et al.
2006/0085392 A1 4/2006 Wang et al.
2006/0094353 A1 5/2006 Neilsen et al.
2006/0101005 A1 5/2006 Yang et al.
2006/0111122 A1 5/2006 Carlson et al.
2006/0116137 A1 6/2006 Jung
2006/0116965 A1 6/2006 Kudo et al.
2006/0148463 A1 7/2006 Zhu et al.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2006/0149461 A1 7/2006 Rowley
2006/0150119 A1 7/2006 Chesnais et al.
2006/0156209 A1 7/2006 Matsuura et al.
2006/0166679 A1 7/2006 Karaoguz et al.
2006/0168300 A1 7/2006 An et al.
2006/0172769 A1 8/2006 Oh
2006/0172778 A1 8/2006 Sundararajan et al.
2006/0179114 A1 8/2006 Deeds
2006/0180649 A1 8/2006 Casey
2006/0183486 A1 8/2006 Mullen
2006/0184320 A1 8/2006 Hong
2006/0184978 A1 8/2006 Casey
2006/0195481 A1 8/2006 Arrouye et al.
2006/0199567 A1 9/2006 Alston
2006/0199612 A1 9/2006 Beyer et al.
2006/0202819 A1 9/2006 Adamczyk et al.
2006/0206264 A1 9/2006 Rasmussen
2006/0211453 A1 9/2006 Schick
2006/0218209 A1 9/2006 Arrouye et al.
2006/0223518 A1 10/2006 Haney
2006/0227047 A1 10/2006 Rosenberg
2006/0229802 A1 10/2006 Vertelney et al.
2006/0229889 A1 10/2006 Hodjat et al.
2006/0247855 A1 11/2006 de Silva et al.
2006/0251034 A1 11/2006 Park
2006/0270421 A1 11/2006 Phillips et al.
2006/0271280 A1 11/2006 O'Clair
2006/0284767 A1 12/2006 Taylor
2006/0286971 A1 12/2006 Maly et al.
2006/0287824 A1 12/2006 Lin
2006/0291639 A1 12/2006 Radziewicz et al.
2006/0293029 A1 12/2006 Jha et al.
2006/0293083 A1 12/2006 Bowen
2007/0001875 A1 1/2007 Taylor
2007/0003040 A1 1/2007 Radziewicz et al.
2007/0005188 A1 1/2007 Johnson
2007/0005233 A1 1/2007 Pinkus et al.
2007/0006098 A1 1/2007 Krumm et al.
2007/0008515 A1 1/2007 Otani et al.
2007/0010942 A1 1/2007 Bill
2007/0016362 A1 1/2007 Nelson
2007/0021915 A1* 1/2007 Breed G08G 1/164 701/301
2007/0027614 A1 2/2007 Reeser et al.
2007/0027628 A1 2/2007 Geelen
2007/0038364 A1 2/2007 Lee et al.
2007/0038369 A1 2/2007 Devries et al.
2007/0042790 A1 2/2007 Mohi et al.
2007/0055684 A1 3/2007 Stevens
2007/0060328 A1 3/2007 Zrike et al.
2007/0061245 A1 3/2007 Ramer et al.
2007/0061301 A1 3/2007 Ramer et al.
2007/0061363 A1 3/2007 Ramer et al.
2007/0071114 A1 3/2007 Sanderford et al.
2007/0073480 A1 3/2007 Singh
2007/0073719 A1 3/2007 Ramer et al.
2007/0087726 A1 4/2007 McGary et al.
2007/0093258 A1 4/2007 Steenstra et al.
2007/0093955 A1 4/2007 Hughes
2007/0106465 A1 5/2007 Adam et al.
2007/0106466 A1 5/2007 Noguchi
2007/0109323 A1 5/2007 Nakashima
2007/0115868 A1 5/2007 Chen et al.
2007/0123280 A1 5/2007 McGary et al.
2007/0124043 A1 5/2007 Ayoub et al.
2007/0124058 A1 5/2007 Kitagawa et al.
2007/0124066 A1 5/2007 Kikuchi et al.
2007/0127439 A1 6/2007 Stein
2007/0127661 A1 6/2007 Didcock
2007/0129888 A1 6/2007 Rosenberg
2007/0130153 A1 6/2007 Nachman et al.
2007/0135136 A1 6/2007 Ische
2007/0135990 A1 6/2007 Seymour et al.
2007/0142026 A1 6/2007 Kuz et al.
2007/0146342 A1 6/2007 Medler et al.
2007/0149212 A1 6/2007 Gupta et al.
2007/0150174 A1 6/2007 Seymour et al.
2007/0150192 A1 6/2007 Wakamatsu et al.
2007/0150320 A1 6/2007 Huang
2007/0153983 A1 7/2007 Bloebaum et al.
2007/0153984 A1 7/2007 Bloebaum et al.
2007/0153986 A1 7/2007 Bloebaum et al.
2007/0155360 A1 7/2007 An
2007/0155404 A1 7/2007 Yamane et al.
2007/0156326 A1 7/2007 Nesbitt
2007/0156337 A1 7/2007 Yanni
2007/0162224 A1 7/2007 Luo
2007/0179854 A1 8/2007 Ziv et al.
2007/0184855 A1 8/2007 Klassen
2007/0191029 A1 8/2007 Zarem et al.
2007/0198304 A1 8/2007 Cohen et al.
2007/0200713 A1 8/2007 Weber et al.
2007/0202887 A1 8/2007 Counts et al.
2007/0204162 A1 8/2007 Rodriguez
2007/0204218 A1 8/2007 Weber et al.
2007/0206730 A1 9/2007 Polk
2007/0208492 A1 9/2007 Downs et al.
2007/0208497 A1 9/2007 Downs et al.
2007/0208498 A1 9/2007 Barker et al.
2007/0208507 A1 9/2007 Gotoh
2007/0218925 A1 9/2007 Islam et al.
2007/0219706 A1 9/2007 Sheynblat
2007/0219708 A1 9/2007 Brasche et al.
2007/0229549 A1 10/2007 Dicke et al.
2007/0232272 A1 10/2007 Gonsalves et al.
2007/0232326 A1 10/2007 Johnson
2007/0233387 A1 10/2007 Johnson
2007/0237096 A1 10/2007 Vengroff et al.
2007/0238491 A1 10/2007 He
2007/0243853 A1 10/2007 Bumiller et al.
2007/0247435 A1 10/2007 Benko et al.
2007/0254676 A1 11/2007 Pedigo et al.
2007/0259674 A1 11/2007 Neef et al.
2007/0260751 A1 11/2007 Meesseman
2007/0266116 A1 11/2007 Rensin et al.
2007/0270159 A1 11/2007 Lohtia et al.
2007/0271328 A1 11/2007 Geelen et al.
2007/0276586 A1 11/2007 Jeon et al.
2007/0276587 A1 11/2007 Johnson
2007/0276596 A1 11/2007 Solomon et al.
2007/0281664 A1 12/2007 Kaneko et al.
2007/0282521 A1 12/2007 Broughton
2007/0282565 A1 12/2007 Bye et al.
2007/0290920 A1 12/2007 Shintai et al.
2007/0296573 A1 12/2007 Schlesier et al.
2007/0299601 A1 12/2007 Zhao et al.
2008/0004789 A1 1/2008 Horvitz et al.
2008/0004791 A1 1/2008 Sera
2008/0004802 A1 1/2008 Horvitz
2008/0005104 A1 1/2008 Flake et al.
2008/0005301 A1 1/2008 Li et al.
2008/0015422 A1 1/2008 Wessel
2008/0019335 A1 1/2008 Wallace et al.
2008/0021632 A1 1/2008 Amano
2008/0024360 A1 1/2008 Taylor
2008/0024364 A1 1/2008 Taylor
2008/0027636 A1 1/2008 Tengler et al.
2008/0030308 A1 2/2008 Johnson
2008/0032703 A1 2/2008 Krumm et al.
2008/0032721 A1 2/2008 MacDonald et al.
2008/0045234 A1 2/2008 Reed
2008/0046176 A1 2/2008 Jurgens
2008/0052407 A1 2/2008 Baudino et al.
2008/0055154 A1 3/2008 Martucci et al.
2008/0065311 A1 3/2008 Bauchot et al.
2008/0070593 A1 3/2008 Altman et al.
2008/0071466 A1 3/2008 Downs et al.
2008/0082254 A1 4/2008 Huhtala et al.
2008/0085727 A1 4/2008 Kratz
2008/0086240 A1 4/2008 Breed
2008/0086455 A1 4/2008 Meisels et al.
2008/0088486 A1 4/2008 Rozum et al.
2008/0091347 A1 4/2008 Tashiro
2008/0096518 A1 4/2008 Mock et al.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2008/0097698	A1	4/2008	Arnold-Huyser et al.	
2008/0098090	A1	4/2008	Geraci et al.	
2008/0104634	A1	5/2008	Gajdos et al.	
2008/0109153	A1	5/2008	Gueziec	
2008/0113672	A1	5/2008	Karr et al.	
2008/0119200	A1	5/2008	McConnel	
2008/0129528	A1	6/2008	Guthrie	
2008/0132243	A1	6/2008	Spalink et al.	
2008/0132251	A1	6/2008	Altman et al.	
2008/0132252	A1	6/2008	Altman et al.	
2008/0140308	A1	6/2008	Yamane et al.	
2008/0140520	A1	6/2008	Hyder et al.	
2008/0153512	A1	6/2008	Kale et al.	
2008/0153513	A1	6/2008	Flake et al.	
2008/0155453	A1	6/2008	Othmer	
2008/0160956	A1	7/2008	Jackson et al.	
2008/0161034	A1	7/2008	Akiyama	
2008/0167078	A1*	7/2008	Eibye	H04M 1/72522 455/566
2008/0167083	A1	7/2008	Wyld et al.	
2008/0167796	A1	7/2008	Narayanaswami	
2008/0167811	A1	7/2008	Geelen	
2008/0168347	A1	7/2008	Hallyn	
2008/0172173	A1	7/2008	Chang et al.	
2008/0172361	A1	7/2008	Wong et al.	
2008/0172374	A1	7/2008	Wolosin et al.	
2008/0176545	A1	7/2008	Dicke et al.	
2008/0177793	A1	7/2008	Epstein et al.	
2008/0178116	A1	7/2008	Kim	
2008/0186162	A1	8/2008	Rajan et al.	
2008/0189033	A1	8/2008	Geelen et al.	
2008/0194273	A1	8/2008	Kansal et al.	
2008/0200142	A1	8/2008	Abdel-Kader et al.	
2008/0207167	A1	8/2008	Bugenhagen	
2008/0209344	A1	8/2008	Knapp et al.	
2008/0225779	A1	9/2008	Bragiel et al.	
2008/0227473	A1	9/2008	Haney	
2008/0233919	A1	9/2008	Kenney	
2008/0242312	A1	10/2008	Paulson et al.	
2008/0248815	A1	10/2008	Busch	
2008/0249667	A1	10/2008	Horvitz et al.	
2008/0249983	A1	10/2008	Meisels et al.	
2008/0268876	A1	10/2008	Gelfand et al.	
2008/0271072	A1	10/2008	Rothschild et al.	
2008/0280600	A1	11/2008	Zhou	
2008/0284642	A1	11/2008	Seacat et al.	
2008/0287124	A1	11/2008	Karabinis	
2008/0288166	A1	11/2008	Onishi	
2008/0293397	A1	11/2008	Gajdos et al.	
2008/0301144	A1	12/2008	Boss et al.	
2008/0310850	A1	12/2008	Pederson et al.	
2008/0318550	A1	12/2008	DeAtley	
2008/0319644	A1	12/2008	Zehler	
2008/0319652	A1	12/2008	Moshfeghi	
2009/0003659	A1	1/2009	Forstall et al.	
2009/0005005	A1	1/2009	Forstall et al.	
2009/0005018	A1	1/2009	Forstall et al.	
2009/0005021	A1	1/2009	Forstall et al.	
2009/0005068	A1	1/2009	Forstall et al.	
2009/0005070	A1	1/2009	Forstall et al.	
2009/0005071	A1	1/2009	Forstall et al.	
2009/0005072	A1	1/2009	Forstall et al.	
2009/0005076	A1	1/2009	Forstall et al.	
2009/0005080	A1	1/2009	Forstall et al.	
2009/0005082	A1	1/2009	Forstall et al.	
2009/0005964	A1	1/2009	Forstall et al.	
2009/0005965	A1	1/2009	Forstall et al.	
2009/0005975	A1	1/2009	Forstall et al.	
2009/0005978	A1	1/2009	Forstall et al.	
2009/0005981	A1	1/2009	Forstall et al.	
2009/0006336	A1	1/2009	Forstall et al.	
2009/0018769	A1	1/2009	Poliak	
2009/0030605	A1	1/2009	Breed	
2009/0031006	A1	1/2009	Johnson	
2009/0033540	A1	2/2009	Breed et al.	
2009/0042585	A1	2/2009	Matsuda	
2009/0089706	A1	4/2009	Furches et al.	
2009/0098857	A1	4/2009	DeAtley	
2009/0177385	A1	7/2009	Matas et al.	
2009/0182492	A1	7/2009	Alten	
2009/0197612	A1	8/2009	Kiiskinen	
2009/0228961	A1	9/2009	Wald et al.	
2009/0234743	A1	9/2009	Wald et al.	
2009/0259573	A1	10/2009	Cheng et al.	
2009/0271271	A1	10/2009	Johnson	
2009/0281724	A1	11/2009	Blumenberg et al.	
2009/0286549	A1	11/2009	Canon et al.	
2010/0082820	A1	4/2010	Furukawa	
2010/0106397	A1	4/2010	Van Essen	
2010/0128935	A1	5/2010	Filley et al.	
2010/0131584	A1	5/2010	Johnson	
2010/0173647	A1	7/2010	Sheynblat	
2010/0207782	A1	8/2010	Johnson	
2010/0285817	A1	11/2010	Zhao et al.	
2011/0051658	A1	3/2011	Jin et al.	
2011/0159887	A1	6/2011	Lohtia et al.	
2011/0276591	A1	11/2011	Bliss et al.	
2012/0270567	A1	10/2012	Johnson	
2013/0225203	A1	8/2013	Johnson	
2014/0066100	A1	3/2014	Johnson	
2018/0172449	A1	6/2018	Forstall et al.	

FOREIGN PATENT DOCUMENTS

CA	2287596	4/2000
CA	2432239	12/2004
CN	1 412 573	4/2003
DE	3 621 456	1/1988
DE	4437360	4/1996
DE	19506890	8/1996
DE	19914257	1/2000
DE	10 141 695	3/2003
EP	0 288 068	7/1992
EP	05-071974	3/1993
EP	0 633 452	11/1995
EP	0 745 867	12/1996
EP	0 762 362	3/1997
EP	0 763 749	3/1997
EP	0 785 535	7/1997
EP	0 786 646	7/1997
EP	0 809 117	11/1997
EP	0 813 072	12/1997
EP	0 699 330	4/1998
EP	0 908 835	4/1999
EP	0 997 808	5/2000
EP	1 083 764	3/2001
EP	1 251 362	10/2002
EP	1 300 652	4/2003
EP	1 406 617	3/2004
EP	1 437 573	4/2004
EP	1 457 928	9/2004
EP	1 465 041	10/2004
EP	1 469 287	10/2004
EP	1 496 338	1/2005
EP	1 659 817	5/2006
EP	1 672 474	6/2006
EP	1 770 956	4/2007
EP	1 790 947	5/2007
EP	1 860 904	11/2007
EP	1 944 701	7/2008
EP	1 933 249	8/2008
EP	1 975 567	10/2008
FR	2730083	8/1996
FR	2754093	4/1998
FR	2772911	6/1999
FR	2810183	12/2001
GB	2 278 196	11/1994
GB	2 322 248	8/1998
GB	2 359 888	9/2001
GB	2 407 230	4/2005
JP	62142215	6/1987
JP	5-191504	7/1993
JP	08-069436	3/1996
JP	8510578	11/1996

(56) **References Cited**

FOREIGN PATENT DOCUMENTS

JP	09-054895	2/1997
JP	9-062993	3/1997
JP	9-80144	3/1997
JP	09-098474	4/1997
JP	9-113288	5/1997
JP	09-153125	6/1997
JP	09-200850	7/1997
JP	9-210710	8/1997
JP	9-319300	12/1997
JP	10-030933	2/1998
JP	10-021259	12/1998
JP	11-234736	8/1999
JP	2000-163379	6/2000
JP	2001-008270	1/2001
JP	2001-160063	6/2001
JP	2001-313972	11/2001
JP	2002-174524	6/2002
JP	2002-310680	10/2002
JP	2002-329296	11/2002
JP	2003-228532	8/2003
JP	2004-045054	2/2004
JP	2004-219146	8/2004
JP	2004-362271	12/2004
JP	2005-106741	4/2005
JP	2005-182146	7/2005
JP	2005-241519	9/2005
JP	2005/277764	10/2005
JP	2006-112338	4/2006
JP	2006-184007	7/2006
JP	2006-270889	10/2006
JP	2006-279838	10/2006
JP	2007-033220	2/2007
JP	2007-033331	2/2007
JP	2007-033368	2/2007
JP	2007-127439	5/2007
JP	2007-147439	6/2007
JP	2007-201699	8/2007
JP	2007-221433	8/2007
JP	2007-240400	9/2007
JP	2007-259291	10/2007
JP	2007-271299	10/2007
JP	2007-304009	11/2007
JP	2007-538265	12/2007
JP	2008-058917	3/2008
JP	2008-129774	6/2008
KR	2004-102440	12/2004
KR	2005-096746	10/2005
TW	200426387	12/2004
WO	WO 1993/020546	10/1993
WO	WO 1994/08250	4/1994
WO	WO 1997/07467	2/1997
WO	WO 1997/24577	7/1997
WO	WO 1997/41654	11/1997
WO	WO 1998/03951	1/1998
WO	WO 1998/07112	2/1998
WO	WO 1998/054682	12/1998
WO	WO 1999/16036	4/1999
WO	WO 1999/44183	9/1999
WO	WO 1999/61934	12/1999
WO	WO 2001/31966	5/2001
WO	WO 2001/37597	5/2001
WO	WO 2001/055994	8/2001
WO	WO 2002/33533	4/2002
WO	WO 2002/054813	7/2002
WO	WO 2003/023593	3/2003
WO	WO 2003/096055	11/2003
WO	WO 2004/008792	1/2004
WO	WO 2004/16032	2/2004
WO	WO 2004/021730	3/2004
WO	WO 2004/34194	4/2004
WO	WO 2004/061576	7/2004
WO	WO 2004/076977	9/2004
WO	WO 2005/06258	1/2005
WO	WO 2005/84052	9/2005
WO	WO 2006/065856	6/2006
WO	WO 2006/113125	10/2006
WO	WO 2007/27065	3/2007
WO	WO 2007/52285	5/2007
WO	WO 2008/051929	5/2008
WO	WO 2008/085740	7/2008
WO	WO 2009/02942	12/2008
WO	WO 2009/140031	11/2009

OTHER PUBLICATIONS

"3rd Generation Partnership Project (3GPP); Technical Specification Group (TSG) RAN; Working Group 2 (WG2); Report on Location Services," TS RAN R2.03 V0.1.0, Apr. 1999, 43 pages.

"3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Stage 2 Functional Specification of Location Services in UTRAN," 3G TS 25.305 v.3.1.0, Mar. 2000, 45 pages.

"3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Functional stage 2 description of location services in UMTS," 3G TS 23.171 v.1.1.0, Nov. 1999, 42 pages.

"Animated Transition," [online] [Retrieved on Oct. 16, 2006]; Retrieved from the Internet URL: http://designinginterfaces.com/Animated Transition; 2 pages.

"DaimlerCrysler Guide5 Usecases Overview Map," 1 page.

Digital cellular telecommunications system (Phase 2+); Location Services (LCS); Service description, Stage 1 (GSM 02.71) ETSI, Apr. 1999, 22 pages.

"Enabling UMTS / Third Generation Services and Applications," No. 11 Report from the UMTS Forum, Oct. 2000, 72 pages.

"Error: could not find a contact with this e-mail address." Outlookbanter.com. Dec. 2006, 12 pages.

"Estonian operator to launch world's first Network-based location services," Ericsson Press Release, Oct. 11, 1999, 2 pages.

"FM 3-25.26 Map Reading and Land Navigation," Headquarters Department of the Army, Washington, DC [online] [Retrieved on Apr. 9, 2014]; Retrieved from the Internet URL: http://155.217.58.58/cgi-bin/atdl.dll/fm/3-25.26/toc.htm; Jul. 20, 2001, pp. 1-7 and J-1 to J-3.

"Frontiers in Electronic Media," *Interactions*, 1997. 4(4):32-64.

"GPS 12 Personal NavigatorTM Owner's Manual & Reference", Garmin Corporation, 1999, 66 pages.

"International Numbering and SMS—Type of Numbering , TON, Numbering Plan Indicator, NPI," *ActiveXperts SMS and Pager Toolkit 4.1*, [online] [Retrieved on Jan. 5, 2007]; Retrieved from the Internet URL: http://www.activexperts.com/support/activsms/tonnpi/; 2 pages.

"International Roaming Guide—Personal Experience(s) from Customer and Community Member," [online] [Retrieved Jun. 26, 2006]; Retrieved from the Internet URL: http://forums.cingular.com/cng/board/message?board.id=international&message.id=1185; 6 pages.

"LaBarge in joint venture on bus system," Internet: URL: http://www.bizjournals.com/stlouis.stories/1998/08/10/focus2.html?t-printable, Aug. 7, 1998, 1 page.

"New Hansets Strut Their Stuff at Wireless '99," Internet: URL: http://findarticles.com/p/articles/mi_m0BMD/is_1999_Feb_11/ai_n27547656/ downloaded from Internet on Feb. 11, 1999, 3 pages.

"New program for mobile blogging for Pocket PC released: MY BLOG," [online] [Retrieved on Apr. 5, 2006]; Retrieved from the Internet URL: http://msmobiles.com/news.php/4067.html; 1 page.

"Numbering and Dialing Plan Within the United States," *Alliance for Telecommunications Industry Solutions*, 2005, 17 pages.

"Report on Location Service feature (LCS) 25.923 v 1.0.0," TSG-RAN Working Group 2 (Radio layer 2 and Radio layer 3), Berlin, May 25-28, 1999, 45 pages.

"Review Guide—Google Maps for mobile (beta)," Google, 2006, 7 pages.

"Revised CR to 09/31 on work item LCS," ETSI SMG3 Plenary Meeting #6, Nice, France, Dec. 13-15, 1999. 18 pages.

"School Buses to Carry Noticom's First Application," Internet: URL: http://findarticles.com/p/articles/mi_m0BMD/is_1999_Feb_17/ai_n27547754/ downloaded from the Internet on Feb. 17, 1999, 2 pages.

(56) **References Cited**

OTHER PUBLICATIONS

"Travel Time Data Collection Handbook—Chapter 5: ITS Probe Vehicle Techniques," FHWA-PL-98-035 Report, Department of Transport, University of Texas, Mar. 1998; [online] [Retrieved from the Internet at http://www.fhwa.dot.gov/ohim/handbook/chap5.pdf, 70 pages.

"User-centered design of mobile solutions," NAMAHN, 2006, 18 pages.

"Windows Live Search for Mobile Goes Final, Still Great," [online] [Retrieved on Mar. 11, 2007]; Retrieved from the Internet URL: http://gizmodo.com/gadgets/software/windows-live-search-for-mobile-goes-final-still-great-236002.php; 3 pages.

"Windows Mobile 6 Professional Video Tour," [online] [Retrieved on Mar. 11, 2007]; Retrieved from the Internet URL: http://gizmodo.com/gadgets/cellphones/windows-mobile-6-professional-video-tour-237039.php; 4 pages.

"Windows Mobile," Microsoft, 2007, 2 pages.

Abowd et al., "Context-awareness in wearable and ubiquitous computing," *1st International Symposium on Wearable Computers*, Oct. 13-14, 1997, Cambridge, MA, 9 pages.

Abowd et al., "Cyberguide: A mobile context-aware tour guide," *Wireless Networks*, 1997, 3(5):421-433.

Akerblom, "Tracking Mobile Phones in Urban Areas," Goteborg University Thesis, Sep. 2000, 67 pages.

Anand et al., "A Quantitative Analysis of Power Consumption for Location-Aware Applications on Smart Phones," *IEEE International Symposium on Industrial Electronics*, Jun. 4-7, 2007, pp. 1986-1991.

Authorized officer Cristina Novelli, International Search Report/Written Opinion in PCT/US2009/041298 dated Oct. 1, 2009, 15 pages.

Authorized officer E Pascual Vallés, International Search Report/Written Opinion in Application No. PCT/US2007/088880 dated Jun. 16, 2008, 5 pages.

Authorized officer Matthew Davies, Invitation to Pay Additional Fees and, Where Applicable, Protest Fee, PCT/US2008/050295 dated Jul. 29, 2008, 10 pages.

Ayatsuka et al., "UbiquitousLinks: Hypermedia Links Embedded in the Real World, Technical Report of Information Processing Society, 96-HI-67," Information Processing Society of Japan, Jul. 11, 1996, 96(62):23-30.

Balliet, "Transportation Information Distribution System," *IBM Technical Disclosure Bulletin*, [online] [Retrieved on Nov. 7, 2008]; Retrieved from the Internet URL: https://www.delphion.com/tdbs/tdb?order=86A+61395; Jun. 1986; 2 pages.

Balsiger et al., "MOGID: Mobile Geo-depended Information on Demand," *Workshop on Position Dependent Information Services (W3C-WAP)*, 2000, 8 pages.

Beard and Palancioglu, "Estimating Positions and Paths of Moving Objects," *IEEE*, 2000, pp. 1-8.

Bederson, "Audio Augmented Reality: A Prototype Automated Tour Guide," *CHI '95 Mosaic of Creativity*, May 7-11, 1995, Chicago, IL, pp. 210-211.

Beeharee and Steed, "Minimixing Pedestrian Navigational Ambiguities Through Geoannotation and Temporal Tagging," Human-Computer Interaction, Interaction Platforms and Techniques, Springer, 2007, pp. 748-757.

Beeharee and Steed, "Natural Wayfinding—Exploiting Photos in Pedestrian Navigation Sysgtems," *Mobile HCI*, Sep. 12, 2006, pp. 81-88.

Benefon ESC1 GSM+GPS Personal Navigation Phone, benefon.com, Copyright 2001, 4 pages.

Berman and Powell, "The Role of Dead Reckoning and Inertial Sensors in Future General Aviation Navigation," *IEEE*, 1998, pp. 510-517.

Bevly and Parkinson, "Cascaded Kalman Filters for Accurate Estimation of Multiple Biases, Dead-Reckoning Navigation, and Full State Feedback Control of Ground Vehicles," *IEEE Transactions on Control Systems in Technology*, 2007, 15(2):199-208.

Binzhuo and Bin, "Mobile Phone GIS Based on Mobile SVG," *IEEE*, pp. 889-892.

Bokharouss et al., "A Location-Aware Mobile Call Handling Assistant," *21st International Conference on Advanced Information Networking and Applications Workshops*, 2007, 8 pages.

Bonsignore, "A Comparative Evaluation of the Benefits of Advanced Traveler Information System (ATIS) Operational Tests," MIT Masters Thesis, Feb. 1994, 140 pps.

Boonsrimuang et al., "Mobile Internet Navigation System," *IEEE*, 2002, pp. 325-328.

Borsodi, "Super Resolution of Discrete Arrivals in a Cellular Geolocation System," University of Calgary Thesis, Apr. 2000, 164 pages.

Brown, "The stick-e document: a framework for creating context-aware applications," *Electronic Publishing*, 1995, 8:259-272.

Brown, "Triggering Information by Context," *Personal Technologies*, 1998, 2:18-27.

Bedka et al., "A Bayesian Method to Improve Mobile Geolocation Accuracy," IEEE 56th Vehicular Technology Conference Proceedings, Sep. 24-28, 2002, Vancouver, CA, 2:1021-1025.

Burnett, "Usable Vehicle Navigation Systems: Are We There Yet?" *Vehicle Electronic Systems 2000*, Jun. 29-30, 2000, 3.1.1-3.1.12.

Camp and DeHayes, Jr., "A computer-based method for predicting transit time parameters using grid systems," *Decision Sciences*, 1974, 5:339-346.

Carew, "Phones that tell you where to drive, meet, eat," [online] [Retrieved May 26, 2007]; Retrieved from the Internet URL http://news.yahoo.com/s/nm/20070525/wr_nm/column_pluggedin_dc_2&printer=1:_ylt=Ahquftn7xmlS2r0FZFeu9G4hi.cA, 2 pages.

Challe, "CARMINAT—An Integrated information and guidance system," *Vehicle Navigation and Information Systems Conference*, Oct. 20-23, 1991, Renault—Direction de la Recherche, Rueil-Malmaison, France.

Change Request for "U.S. specific Emergency Services requirements included as an informative annex," Nov. 29, 1999, 2 pages.

Chamy, "AT&T puts 411 to the text," [online] [Retrieved Mar. 4, 2009]; Retrieved from the Internet URL http://news.cnet.com/ATT-puts-411-to-the-text/2100-1039_3-1000669.html; May 8, 2003; 2 pages.

Cheverst et al., "Architectural Ideas for the Support of Adaptive Context-Aware Applications," *Proceedings of Workshop on Infrastructure for Smart Devices—How to Make Ubiquity an Actuality, HUC'00*, Bristol, Sep. 2000, 3 pages.

Cheverst et al., "Design of an Object Model for a Context Sensitive Tourist Guide," *Computers and Graphics*, 1999, 23(6):883-891.

Cheverst et al., "Developing Interfaces for Collaborative Mobile Systems," 1999, 15 pages.

Cheverst et al., "Experiences of Developing and Deploying a Context-Aware Tourist Guide: The GUIDE Project," 2000, pp. 20-31.

Cheverst et al., "Exploiting Context to Support Social Awareness and Social Navigation," *SIGGROUP Bulleting* Dec. 2000, 21(3):43-48.

Cheverst et al., "Services to Support Consistence in Mobile Collaborative Applications," *Proc. 3rd International Workshop on Services in Distributed Networked Environments*, 1996, 8 pages.

Cheverst et al., "Sharing (Location) Context to Facilitate Collaboration Between City Visitors," 2000, 8 pages.

Cheverst et al., "Supporting Collaboration in Mobile-aware Groupware," *Workshop on Handheld CSCW*, 1998, 6 pages.

Cheverst et al., "The Role of Connectivity in Supporting Context-Sensitive Applications," *HUC'99 LNCS 1707*, 1999, pp. 193-209.

Cheverst et al., "The Support of Mobile-Awareness in Collaborative Groupware," *Personal Technologies*, 1999, 3:33-42.

Cho et al., "A Traveler Information Service Structure in Hybrid T-DMB and Cellular Communication Network," *IEEE*, 2006, pp. 747-750.

Christie et al., "Development and Deployment of GPS wireless devices for E911 and Location based services." Position, location and Navigation Symposium, Palm Springs, CA, Apr. 15-18, 2002, pp. 60-65w.

(56) **References Cited**

OTHER PUBLICATIONS

Chua et al., "Intelligent Portal for Event-triggered SMS Alerts," *2nd International Conference on Mobile Technology, Applications and Systems*, 2005, 7 pages.
Civilis et al., "Efficient Tracking of Moving Objects with Precision Guarantees," *Proc. First Annual International Conference on Mobile and Ubiquitous Systems Networking and Services* (*MobiQuitous '04*), 2004, 10 pages.
Clarke et al., "Development of Human Factors Guidelines for Advanced Traveler Information Systems (ATIS) and Commercial Vehicle Operations (CVO): Comparable Systems Analysis," U.S. Department of Transportation Federal Highway Administration, Publication No. FHWA-RD-95-197, Dec. 1996, 212 pages.
Costa et al., "Experiments with Reflective Middleware," *Proceedings of the ECOOP '98 Workshop on Reflective Object-Oriented Programming and Systems, ECOOP '98 Workshop Reader*, 1998, 13 pages.
Dalrymple, "Google Maps adds locator, but not for iPhone," [online] [Retrieved Nov. 30, 2007]; Retrieved from the Internet URL: http://news.yahoo.com/s/macworld/20071130/tc_macworld/googlemaps20071130_0&printer=1;_ylt=Auvf3s6LQK pOaJlb954T DQn6gB; 1 page.
Davies et al., "Caches in the Air: Disseminating Tourist Information in the Guide System," *Second IEEE Workshop on Mobile Computer Systems and Applications*, Feb. 25-26, 1999, 9 pages.
Davies et al., "L2imbo: A distributed systems plastform for mobile computing," *Mobile Networks and Applications*, 1998, 3:143-156.
Dey et al., "CyberDesk: a framework for providing self-integrating context-aware services," *Knowledge-Based Systems*, 1998, 11:3-13.
Dey, "Context-Aware Computing: The CyberDesk Project," [online] Retrieved from the Internet: URL: http://www.cc.gatech.edu/fce/cyberdesk/pubs/AAAI98/AAAI98.html; *AAAI '98 Spring Symposium*, Stanford University, Mar. 23-25, 1998, downloaded from the Internet on Aug. 6, 2010, 8 pages.
Dibdin, "Where are mobile location based services?" *CM316 Multimedia Systems Paper*, Dec. 14, 2001, 8 pages.
Dix et al., "Exploiting Space and Location as a Design Framework for Interactive Mobile Systems," *ACM Transactions on Computer-Human Interaction* (*TOCHI*)—*Special issue on human-computer interaction with mobile systems*, 2000, 7(3):285-321.
Dommety and Jain, "Potential Networking Applications of Global Positioning Systems (GPS)," [online] [Retrieved on Nov. 18, 2008]; [Retrieved from the Internet URL: http://arxiv.org/ftp/cs/papers/9809/9809079.pdf; OSU Technical Report TR-24, Apr. 1996, 41 pages.
Drane and Rizos, "Role of Positioning Systems in ITS," *Positioning Systems in Intelligent Transportation Systems*, Dec. 1997, pp. 312, 346-349.
Drane et al., "Positioning GSM Telephones," *IEEE Communications Magazine*, Apr. 1998, pp. 46-59.
Drane et al., "The Accurate Location of Mobile Telephones," *Third Annual World Congress on Intelligent Transport Systems*, Orlando, Florida, Oct. 1996, 8 pages.
Dunn and Toohey, "Wireless Emergency Call System," *IBM Technical Disclosure Bulletin*, Sep. 1994; 1 page.
Ebine, "Dual frequency resonant base station antennas for PDC systems in Japan," *IEEE*, 1999, pp. 564-567.
Efstratiou and Cheverst, "Reflection: A Solution for Highly Adaptive Mobile Systems," *2000 Workshop on Reflective Middleware*, 2000, 2 pages.
Efstration et al., "Architectural Requirements for the Effective Support of Adaptive Mobile Applications," 2000, 12 pages.
Evans et al., "In-Vehicle Man-Machine Interaction. The Socrates Approach," *Vehicle Navigation & Information System Conference Proceedings*, 1994, Aug. 31-Sep. 2, 1994, pp. 473-477.
European Search Report in EP 12 15 4024 dated Apr. 10, 2012, 6 pages.
European Search Report in EP 12 15 4025 dated Apr. 12, 2012, 7 pages.
European Search Report in EP 12 15 4026 dated Apr. 10, 2012, 5 pages.
European Search Report in EP 12 15 4027 dated Apr. 10, 2012, 7 pages.
European Search Report in EP 09 00 0094 dated Apr. 28, 2009, 7 pages.
International Preliminary Report on Patentability in PCT/US2009/055065 dated Mar. 31, 2011, 8 pages.
International Preliminary Report on Patentability in PCT/US2010/033003 dated Nov. 10, 2011, 6 pages.
Partial European Search Report in EP 09 17 0460 dated Dec. 28, 2009, 6 pages.
Examination Report in JP 2011-509530 dated Apr. 17, 2013, 9 pages.
Feddema et al., "Cooperative Sentry Vehicles and Differential GPS Leapfrog," 2000, *United States Department of Energy*, pp. 1-12.
Fischer et al., "System Performance Evaluation of Mobile Positioning Methods," *IEEE*, Aug. 2002, pp. 1962-1966.
Flinn and Satyanarayanan, "PowerScope: A Tool for Profiling the Energy Usage of Mobile Applications," *Proc. WMCSA '99 Second IEEE Workshop on Mobile Computing Systems and Applications*, Feb. 25-26, 1999, 9 pages.
French and Driscoll, "Location Technologies for ITS Emergency Notification and E911," *Proc. 1996 National Technical Meeting of The Institute of Navigation*, Jan. 22-24, 1996, pp. 355-359.
Freundschuh, "Does 'Anybody' Really Want (Or Need) Vehicle Navigation Aids?" *First Vehicle Navigation and Information System Conference*, Sep. 11-13, 1989, Toronto, Canada, 5 pages.
Friday et al., "Developing Adaptive Applications: The MOST Experience," *J. Integrated Computer-Aided Engineering*, 1999, pp. 143-157.
Gould, "The Provision of Usable Navigation Assistance: Considering Individual Cognitive Ability," *First Vehicle Navigation and Information System Conference*, Sep. 11-13, 1989, Toronto, Canada, 7 pages.
Green et al., "Suggested Human Factors Design Guidelines for Driver Information Systems," *Technical Report UMTR1-93-21*, Nov. 1993, 119 pages.
Gunnarsson et al., "Location Trial System for Mobile Phones," *IEEE*, 1998, pp. 2211-2216.
Guo et al., "An Intelligent Query System Based on Chinese Short Message Service for Restaurant Recommendation," *Sixth International Conference on the Management of Mobile Business* (*ICMB 2007*), 2007, 1 page.
Hameed and Shabnam, "An Intelligent Agent-Based Medication and Emergency System," *IEEE*, 2006, pp. 3326-3330.
Helal et al., "Drishti: An Integrated Navigation System for Visually Impaired and Disabled," *Fifth International Symposium on Wearable Computers* (*ISWC'01*), 2001, pp. 149-156.
Hodes and Katz, "Composable ad hoc location-based services for heterogeneous mobile clients," *Wireless Networks*, 1999, 5:411-427.
Hohman et al., "GPS Roadside Integrated Precision Positioning System," *Position Location and Navigation Symposium*, 2000, pp. 221-230.
Hoogenraad, "Location Dependent Services," *3rd AGILE Conference on Geographic Information Science*, Helsinki/Espoo, Finland, May 25-27, 2000, pp. 74-77.
Jirawimut et al., "A Method for Dead Reckoning Parameter Correction in Pedestrian Navigation System," *IEEE Transactions on Instrumentation and Measurement*, 2003, 52(1):209-215.
Jose and Davies, "Scalabe and Flexible Location-Based Services for Ubiquitous Information Access," *HUC'99, LNCS 1707*, 1999, pp. 52-66.
Ju et al., "RFID Data Collection and Integration Based on Mobile Agent," *IEEE*, 2006, 4 pages.
Kbar and Mansoor, "Mobile Station Location based on Hybrid of Signal Strength and Time of Arrival," *Proc. International Conference on Mobile Business* (*ICMB'05*), 2005, 7 pages.
Khattak et al., "Bay Area ATIS Testbed Plan," Research Reports, California Partners for Advanced Transit and Highways (PATH), Institute of Transportation Studies, UC Berkeley, Jan. 1, 1992, 83 pages.

(56) **References Cited**

OTHER PUBLICATIONS

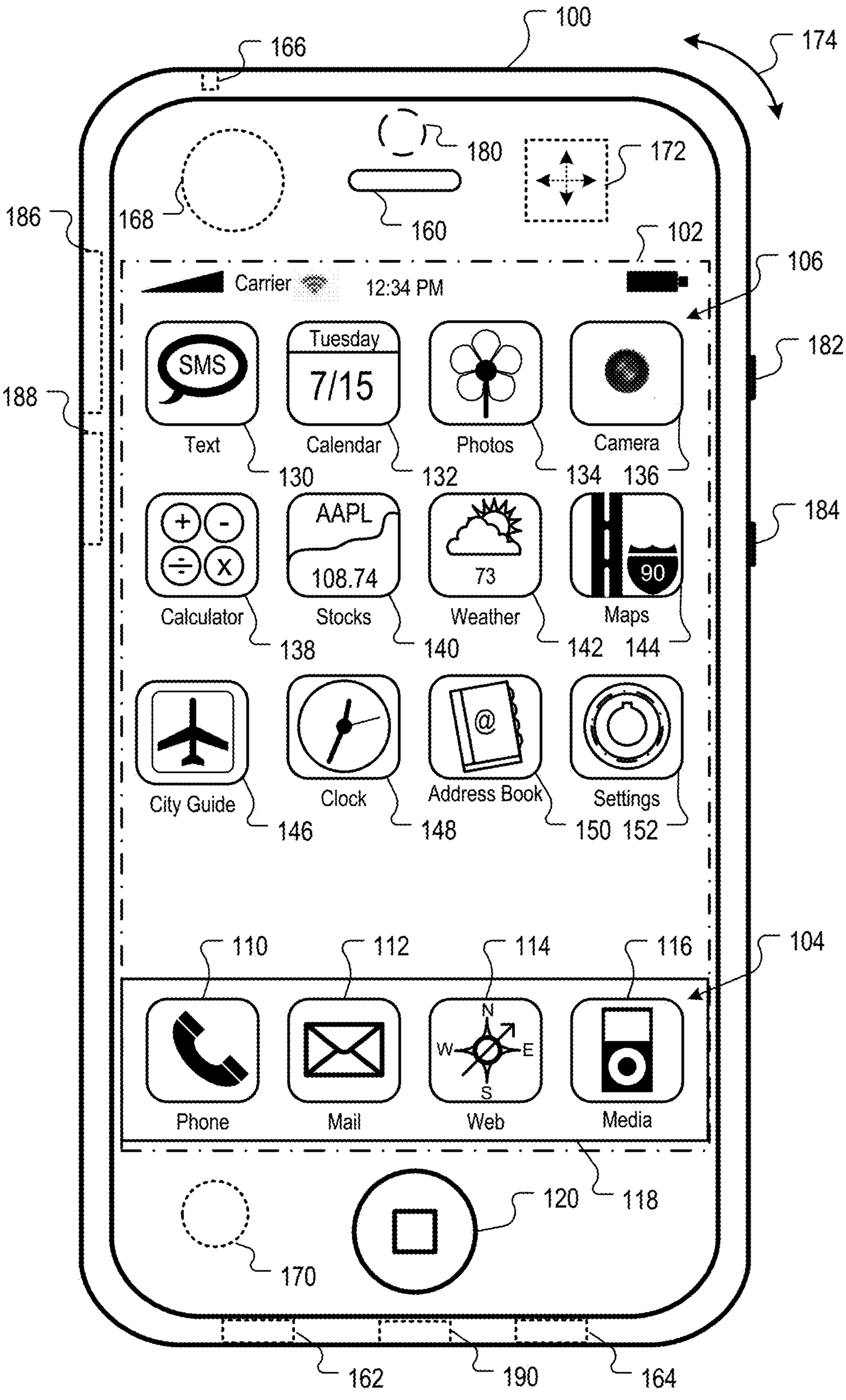
Klinec and Nolz, "Nexus-Positioning and Communication Environment for Spatially Aware Applications," *IAPRS*, Amsterdam, 2000, 7 pages.
Koide and Kato, "3-D Human Navigation System and Consideration of Neighboring Space Information," *2006 IEEE International Conference on Systems, Man and Cybernetics*, Oct. 8-11, 2006, Taipei, Taiwan, pp. 1693-1698.
Kovacs et al., "Adaptive Mobile Access to Context-aware Services," *Proc. ASAMA '99 Proc. First International Symposium on Agent Systems and Applications Third International Symposium on Mobile Agents*, IEEE Computer Society Washington, DC, 1999, 12 pages.
Kreller et al., "A Mobile-Aware City Guide Application." *ACTS Mobile Communication Summit*, 1998, Rhodes, Greece, 7 pages.
Kreller et al., "UMTS: A Middleware Architecture and Mobile API/Approach," *IEEE Personal Communications*, Apr. 1998, pp. 32-38.
Kugler and Lechner, "Combined Use of GPS and LORAN-C in Integrated Navigation System," *Fifth International Conference on Satellite Systems for Mobile Communications and Navigation*, London, UK, May 13-15, 1996, pp. 199-207.
Kyriazakos et al., "Optimization of the Handover Algorithm based on the Position of the Mobile Terminals," *Communications and Vehicular Technology*, Oct. 2000, pp. 155-159.
Leonhardt and Magee. "Multi-Sensor Location Tracking," *MOBICOM 98*, Dallas, TX, pp. 203-214.
Leonhardt and Magee, "Towards a general location service for mobile environments," *Proc. Third International Workshop on Services in Distributed and Networked Environments*, Jun. 3-4, 1996, 8 pages.
Lloyd and Tianlin, "Cellular phone base stations installation violate the Electromagnetic Compatibility regulations," *2004 4th International Conference on Microwave and Millimeter Wave Technology Proceedings*, 2004, pp. 920-922.
Long et al., "Rapid Prototyping of Mobile Context-Aware Applications: The Cyberguide Case Study," *MobiCom '96*, 1996, 11 pages.
Lusky et al., "Mapping the Present," *ColoradoBiz*, Nov. 1999, 26(11):16-17.
Maaβ, "Location-Aware Mobile Applications based on Directory Services," *MOBICOM 97*, 1997, Budapest, Hungary, pp. 23-33.
Mahmassani et al., "Providing Advanced and Real-Time Travel/Traffic Information to Tourists," *Center for Transportation Research, Bureau of Engineering Research, The University of Texas at Austin*, Oct. 1998, 15 pages.
Manabe et al., "On the M-CubITS Pedestrian Navigation System," *Proc. IEEE Intelligent Transportation Systems Conference*, Toronto, Canada, Sep. 17-20, 2006, pp. 793-798.
Mark, "A Conceptual Model for Vehicle Navigation Systems," *First Vehicle Navigation and Information System Conference*, Sep. 11-13, 1989, Toronto, Canada 11 pages.
Maxwell et al., "Alfred: The Robot Waiter Who Remembers You," *AAAI Technical Report WS-99-15*, 1999, 12 pages.
McCarthy and Meidel, "ACTIVEMAP: A Visualization Tool for Location Awareness to Support Informal Interactions," *HUC '99, LNCS 1707*, 1999, pp. 158-170.
Meier and Cahill, "Location-Aware Event-Based Middleware: A Paradigm for Collaborative Mobile Applications?". *8th Caber Net Radicals Workshop*, 2003, 5 pages.
Microsoft Outlook 2003 User's Guide, http://opan.admin.ufl.edu/user_guides/outlook2003.htm, Aug. 2004, 17 pages.
Miller et al., "Integrating Hierarchical Navigation and Querying: A User Customizable Solution," *ACM Multimedia Workshop of Effective Abstractions in Multimedia Layout, Presentation, and Interaction*, San Francisco, CA, Nov. 1995, 8 pages.
Miller et al., "Synchronization of Mobile XML Databases by Utilizing Deferred Views," *IEEE*, 2004, pp. 186-191.
Mio Technology "User's Manual MioMap 2.0," Mio DigiWalker, 2005, 59 pages.
Mio Technology: "27 Countries in your pocket," [online] [Retrieved on Jul. 9, 2008]; Retrieved from the Internet URL: http://www.mio-tech.be/en/printview/press-releases-2005-09-29.htm>; 1 page.
Mio Technology: "Mio 269+ User's Manual," [online] [Retrieved on Jul. 9, 2008]; Retrieved from the Internet URL: http://www.mio-tech.be/Manuals/269+/Device-Manual/268-plus-269-plus-Device-Manual-EN.pdf> Mio DigiWalker, Aug. 2005, 44 pages.
Muraskin, "Two-Minute Warnings for School Bus Riders," Internet: URL: http://www.callcentermagazine.com/shared/printableArticle.jhtml:jsessionid=PQHISZXW . . . Jul. 1, 1999, 3 pages.
Nagao et al., Walk Navi: A Location-Aware Interactive Navigation/Guideline System and Software III, First Edition, pp. 9-48, published by Kindai-Kagaku-Sya Co. Ltd., Dec. 10, 1995.
Nardi et al., "Integrating Communication and Information Through Contact Map," *Communications of the ACM*, 2002, 45(4):89-95.
Ni and Deakin, "On-Board Advanced Traveler Information Systems," Dec. 1, 2002, 10 pages.
Noonan and Shearer, "Intelligent Transportation Systems Field Operational Test Cross-Cutting Study Advance Traveler Information systems," *Intelligent Transportation Systems Field Operational Test Cross-Cutting Study*, Sep. 1998, 26 pages.
Northard, "Docking Station Communication Link," *IBM Technical Disclosure Bulletin*, 1994, 4 pages.
O'Grady et al., "A Tourist-Centric Mechanism for Interacting with the Environment," Proceedings of the First International Workshop on Managing Interactions in Smart Environments (MANSE '99), Dublin, Ireland, Dec. 1999, pp. 56-67.
Oh et al., "Spatial Applications Using 4S Technology for Mobile Environment," *IEEE*, 2002, 3 pages.
Paksoy et al., "The Global Position System-Navigation Tool of the Future," *J. Electrical & Electronics*, 2002, 2(1):467-476.
Parikh, "Tele Locate," *IBM Technical Disclosure Bulletin*, [online] [Retrieved on Nov. 7, 2008]; Retrieved from the Internet URL: https://www.delphion.com/tdbs/tdb?order=92A+62775; 1992, 1 page.
Pascoe et al., "Developing Personal Technology for the Field," *Personal Technologies*, 1998, 2:28-36.
Pfoser et al., "Dynamic Travel Time Maps—Enabling Efficient Navigation," *Proc. 18th International Conference on Scientific and Statistical Database Management* (*SSDBM'06*), 2006, 10 pages.
Popescu-Zeletin et al., "Applying Location-Aware Computing for Electronic Commerce: Mobile Guide," *Proc. 5th Conference on Computer Communications*, AFRICOM-CCDC'98,Oct. 20-22, 1998, 14 pages.
Portfolio 2007; [online] [Retrieved on Jun. 14, 2007]; Retrieved from the Internet URL: http://eric.wahlforss.com/folio; 3 pages.
Pungel, "Traffic control-beat the jam electronically," *Funkschau*, 1988, 18:43-45 (w/English translation).
RD 409052, Research Disclosure Alerting Abstract, "Location dependent information for satellite based vehicle communication—required application of Global Position System (GPS) to automatically extract relevant portions of data package as vehicle changes position," May 10, 1998, 1 page.
Rekimoto et al., "Augment-able Reality: Situated Communication through Physical and Digital Spaces," *Second International Symposium on Wearable Computers* (*ISWC'98*), 1998, pp. 1-8.
Rillings and Betsold. "Advanced driver information systems," *Vehicular Technology*, IEEE Vehicular Technology Society, 1991, 40:31-40.
Rogers et al., "Adaptive User Interfaces for Automotive Environments," *Proc. IEEE Intelligent Vehicles Symposium 2000*, Oct. 3-5, 2000, Dearborn, MI, pp. 662-667.
Rozier et al. "Hear&There: An Augmented Reality System of Linked Audio," *Proceedings of the International Conference on Auditory Display*, Atlanta, GA, Apr. 2000, pp. 1-5.
Samadani et al., "PathMarker: systems for capturing trips," *2004 IEEE International Conference on Multimedia and Expo* (*ICME*), Jun. 27-30, 2004, 3:2123-2126.
Schreiner, "Where We At? Mobile Phones Bring GPS to the Masses," *IEEE Computer Society*, May/Jun. 2007, pp. 6-11.
Serafin et al., "Functions and Features of Future Driver Information Systems," *Technical Report UMTRI-91-16*, May 1991, 104 pages.

(56) **References Cited**

OTHER PUBLICATIONS

Shekhar and Liu, "Genesis and Advanced Traveler Information Systems (ATIS): Killer Applications for Mobile Computing?" *NSF Mobidata Workshop on Mobile and Wireless Information Systems*, Nov. 1994, 20 pages.
Shibata et al., "Development and Integration of Generic Components for a Teachable Vision-Based Mobile Robot," *IEEE/ASME Transactions on Mechatronics*, 1996, 1(3):230-236.
Spohrer, "New Paradigms for Using Computers (Abstract)," 1997; [online]; Retrieved from the Internet URL: http://www.almaden.ibm.com/almaden/npuc97/1997/spohrer.htm; 1 page.
Sung et al., "Towards Reliable Peer-to-Peer Data Sharing over Mobile Ad hoc Networks," *IEEE*, 2005, 5 pages.
Tarumi et al., "Public Applications of SpaceTag and Their Impacts," *Digital Cities, LNCS 1876*, 2000, pp. 350-363.
Tebbutt, "Dial your way out of the woods," *The Australian*, Feb. 2000, 1 page.
Tijerina et al., "Driver Workload Assessment of Route Guidance System Destination Entry While Driving: A Test Track Study," *Proceedings of the 5th ITS World Congress*, Oct. 12-16, 1998, Seoul, Korea, 9 pages.
Tso et al., "Always On, Always Connected Mobile Computing," Mobile Communications Operation—Mobile Handheld Products Group, 1996, pp. 918-924.
Tsuzawa and Okamoto, "Advanced Mobile Traffic Information and Communication System," *First Vehicle Navigation and Information Systems Conference*, Sep. 11-13, 1989, Toronto, Canada, Abstract only.
Wang and Huang, "An Unified Vehicle Supervising and Traffic Information System," *IEEE*, 1996, pp. 968-972.
Wang and Lin, "Location Aware Information Agent over WAP," *Tamkang Journal of Science and Engineering*, 2000, 3(2):107-115.
Weinberg, "Using the ADXL202 in Pedometer and Personal Navigation Applications," AN-602, Analog Devices, Jul. 2002, 8 pages.
Weiβ et al., "Zone Services—An Approach for Location-based Data Collection," *Proceedings of the 8th IEEE International Conference on E-Commerce Technology and the 3rd IEEE International Conference on Enterprise Computing, E-Commerce and E-Services (CEC/EEE'06)*, 2006, 8 pages.
Wheeler et al., "Development of Human Factors Guidelines for Advanced Traveler Information Systems and Commercial Vehicle Operations: Task Analysis of ATIS/CVO Functions," US Dept. Transportation Federal Highway Administration Research and Development, Publication No. FHWA-RD-95-176, Nov. 1996, 124 pps.
Wong, "GPS: making roads safer and solving traffic tangles," *Asia Engineer*, 23(9):31-32.
Wu et al., "A Multimedia System for Route Sharing and Video-Based Navigation," *IEEE*, 2006, pp. 73-76.
Yamamoto et al., "Position Location Technologies Using Signal Strength in Cellular Systems," *IEEE 53rd Vehicular Technology Conference*, May 6-9, 2001, Rhodes, Greece. 53:2570-2574.
Yang and Marsland, "Global Snapshots for Distributed Debugging," *IEEE*, 1992, pp. 436-440.
Yanyan et al., "The Model of Optimum Route Selection in Vehicle Automatic Navigation System Based on Unblocked Reliability Analyses," *IEEE*, 2003, pp. 975-978.
Ygnace et al., "Travel Time Estimation on the San Francisco Bay Area Network Using Cellular Phones as Probes." Working Paper, Institute of Transportation Studies. University of California, Berkeley, 2000, 58 pages.
Yim et al., "Travinfo Field Operational Test: Work Plan for the Target, Network, and Value Added Reseller (VAR) Customer Studies," *Working Papers, California Partners for Advanced Transit and Highways (PATH), Institute of Transportation Studies, UC Berkeley*, Apr. 1, 1997, 49 pages.
Yogesh C. Rathod, Third Party Submission in U.S. Appl. No. 12/233,358 dated Mar. 30, 2010, 12 pages.
Yokote, "The Apertos Reflective Operating System: The Concept and Its Implementation," *OOPSLA'92*, pp. 414-434.
Zhao, "Mobile Phone Location Determination and Its Impact on Intelligent Transportation Systems," *IEEE Transactions on Intelligent Transportation Systems*, Mar. 2000, 1(1):55-64.

* cited by examiner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174
180
172
168
160
186
102
106
Carrier
12:34 PM
182
188
SMS
Tuesday
7/15
Text
Calendar
Photos
Camera
130
132
134
136
184
AAPL
108.74
73
90
Calculator
Stocks
Weather
Maps
138
140
142
144
@
City Guide
Clock
Address Book
Settings
146
148
150
152
110
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W
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Web
Media
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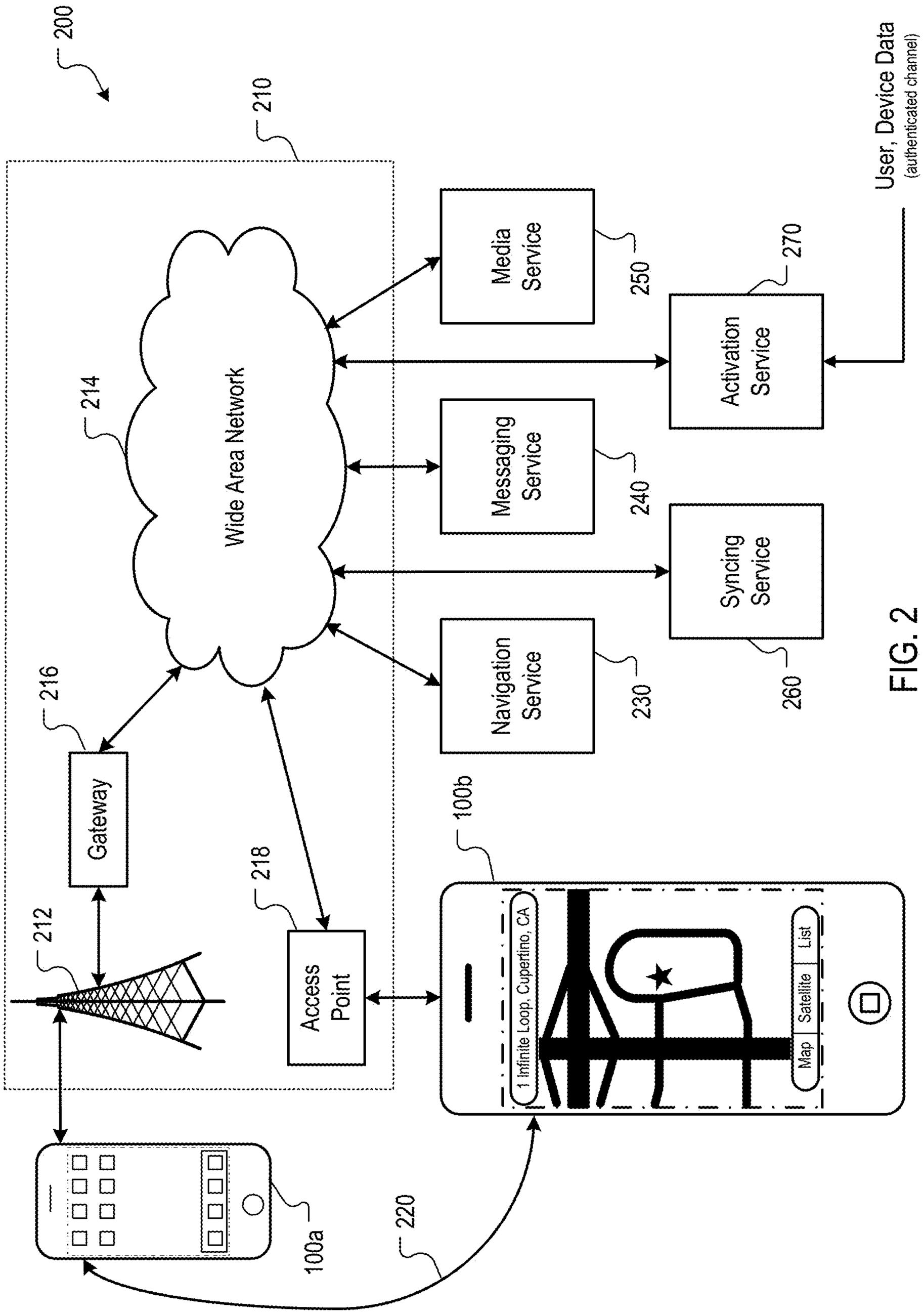
162
190
164

FIG. 1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Wide Area Network
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Gateway
218
212
Access Point
Media Service
250
Messaging Service
240
Navigation Service
230
Syncing Service
260
270
Activation Service
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100b
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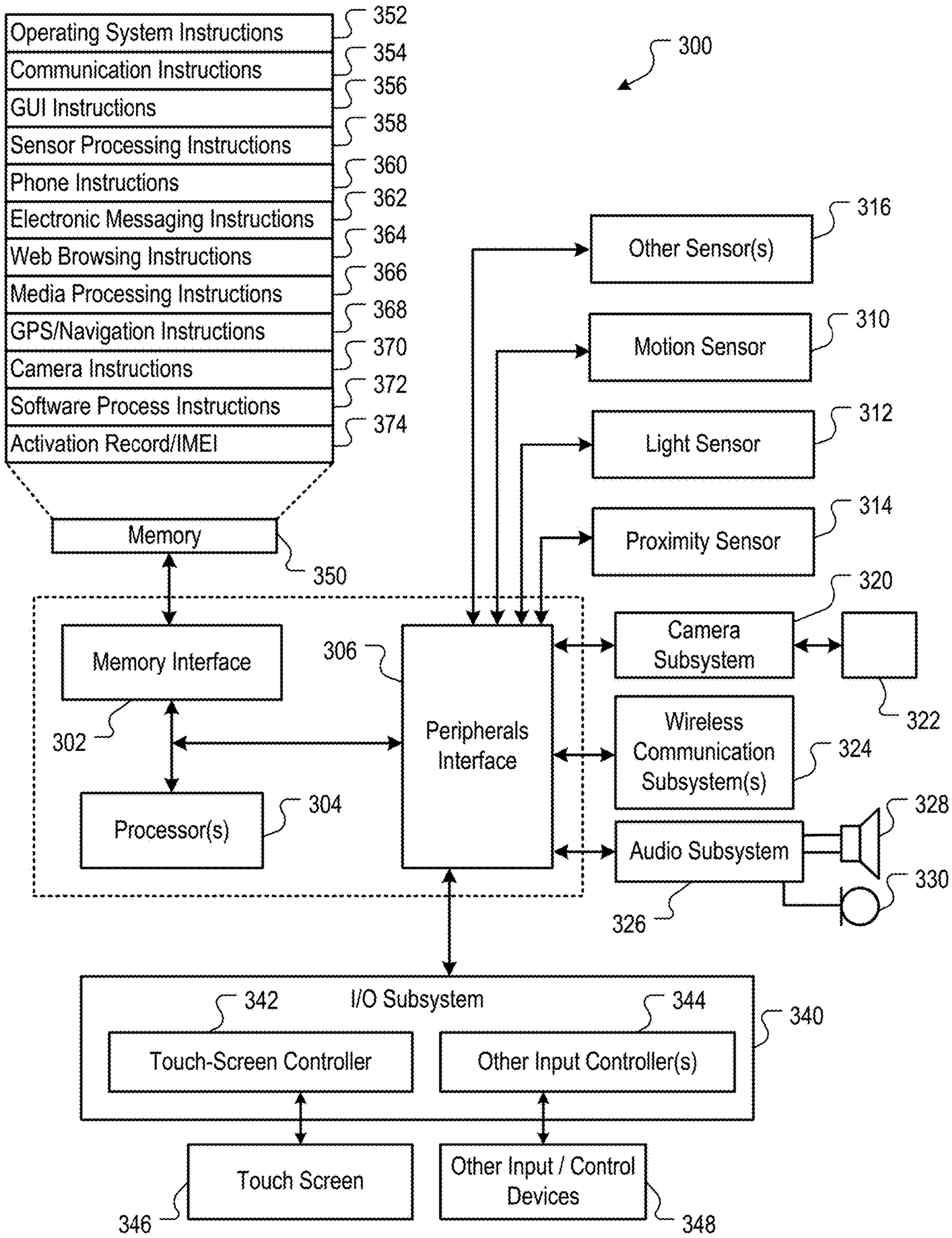
Map
Satellite
List
100a
220

FIG. 2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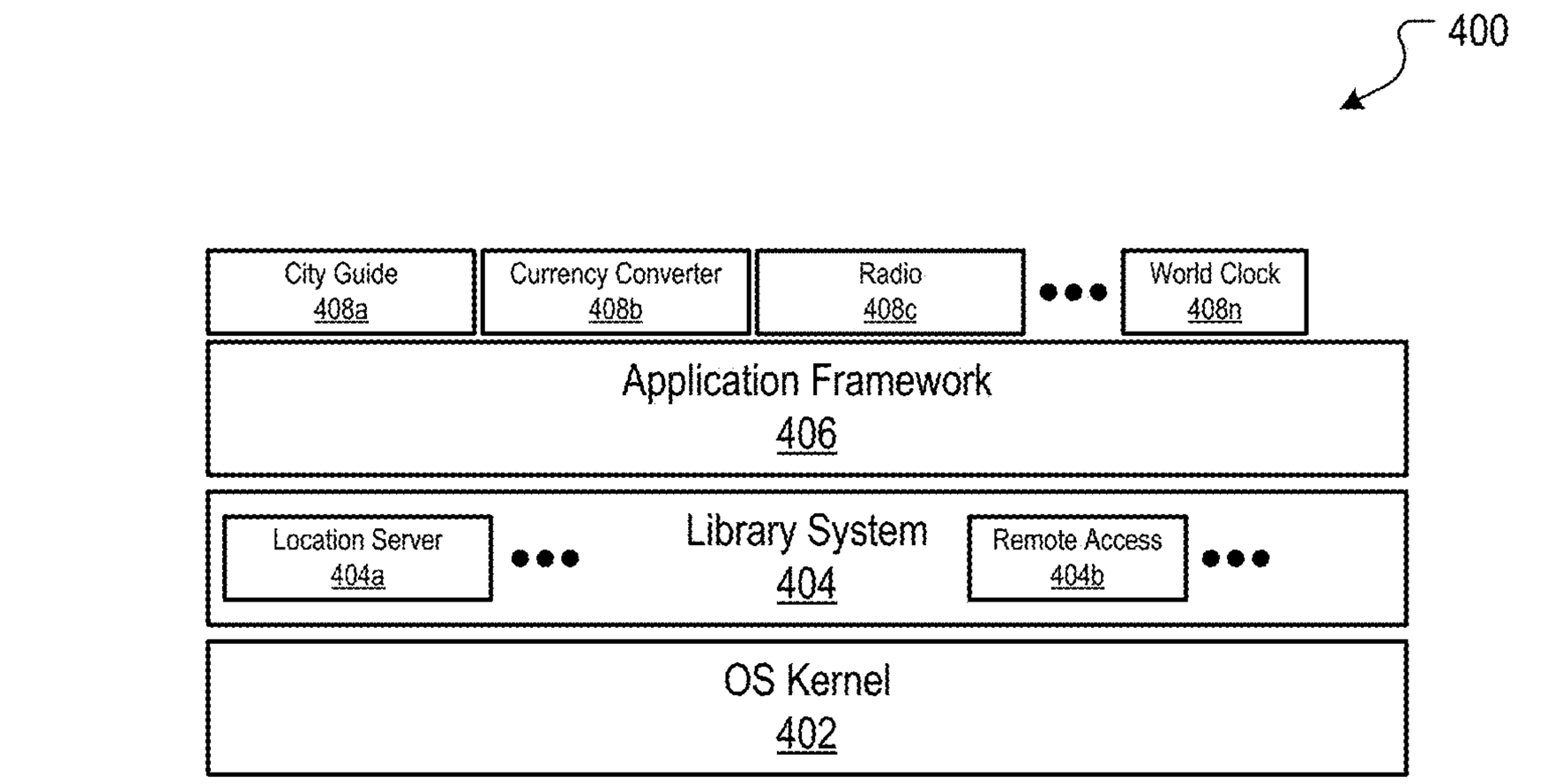
Communication Instructions
354
GUI Instructions
356
Sensor Processing Instructions
358
Phone Instructions
360
Electronic Messaging Instructions
362
Web Browsing Instructions
364
Media Processing Instructions
366
GPS/Navigation Instructions
368
Camera Instructions
370
Software Process Instructions
372
Activation Record/IMEI
374
Memory
350
300
Other Sensor(s)
316
Motion Sensor
310
Light Sensor
312
Proximity Sensor
314
Memory Interface
302
306
Peripherals Interface
Processor(s)
304
Camera Subsystem
320
322
Wireless Communication Subsystem(s)
324
Audio Subsystem
326
328
330
I/O Subsystem
342
344
340
Touch-Screen Controller
Other Input Controller(s)
Touch Screen
346
Other Input / Control Devices
348

FIG. 3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City Guide
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Currency Converter
408b
Radio
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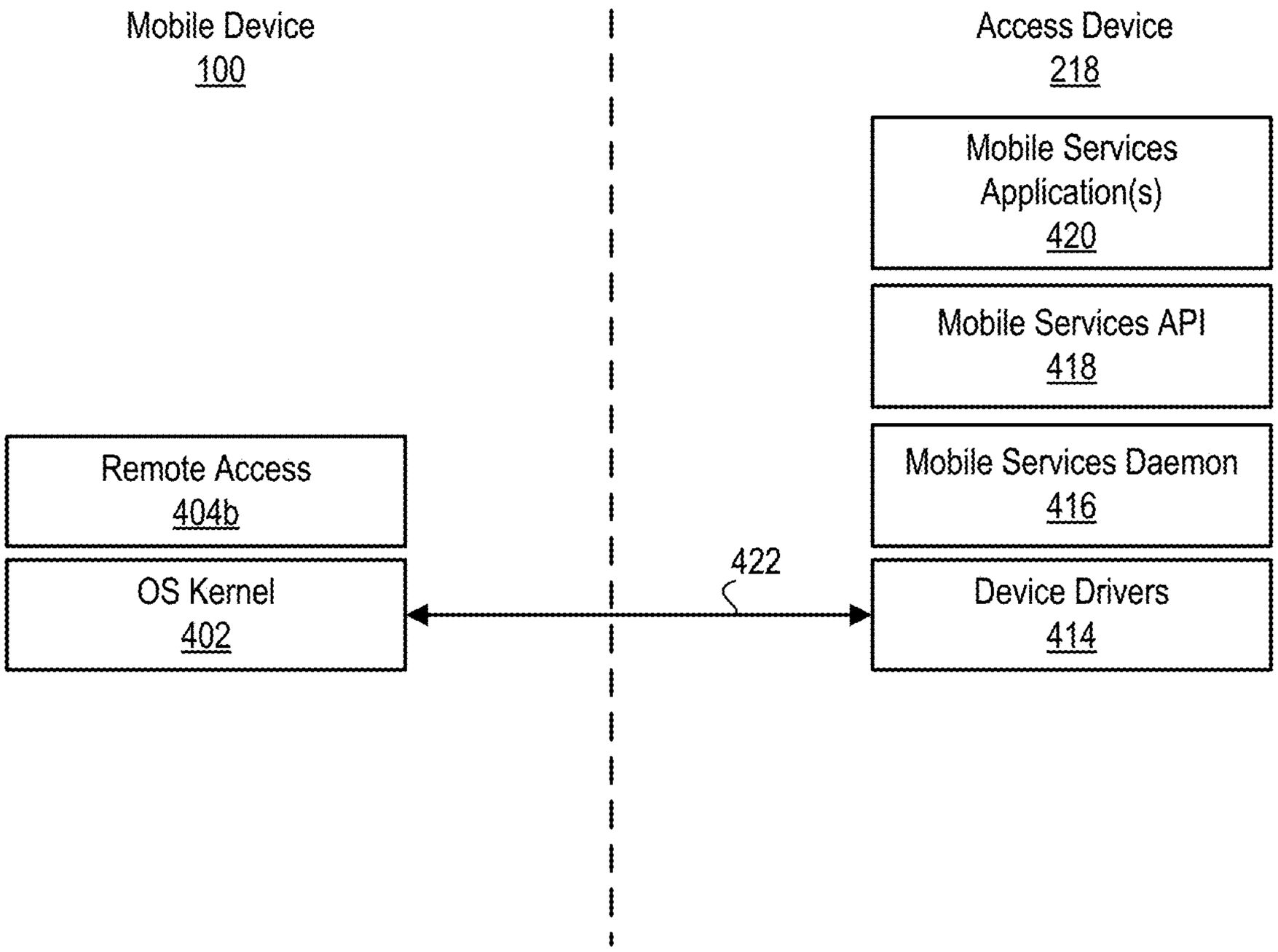
World Clock
408n
Application Framework
406
Location Server
404a
Library System
404
Remote Access
404b
OS Kernel
402

FIG. 4A


Mobile Device
100
Access Device
218
Mobile Services
Application(s)
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Mobile Services API
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Mobile Services Daemon
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Remote Access
404b
OS Kernel
402
422
Device Drivers
414

FIG. 4B

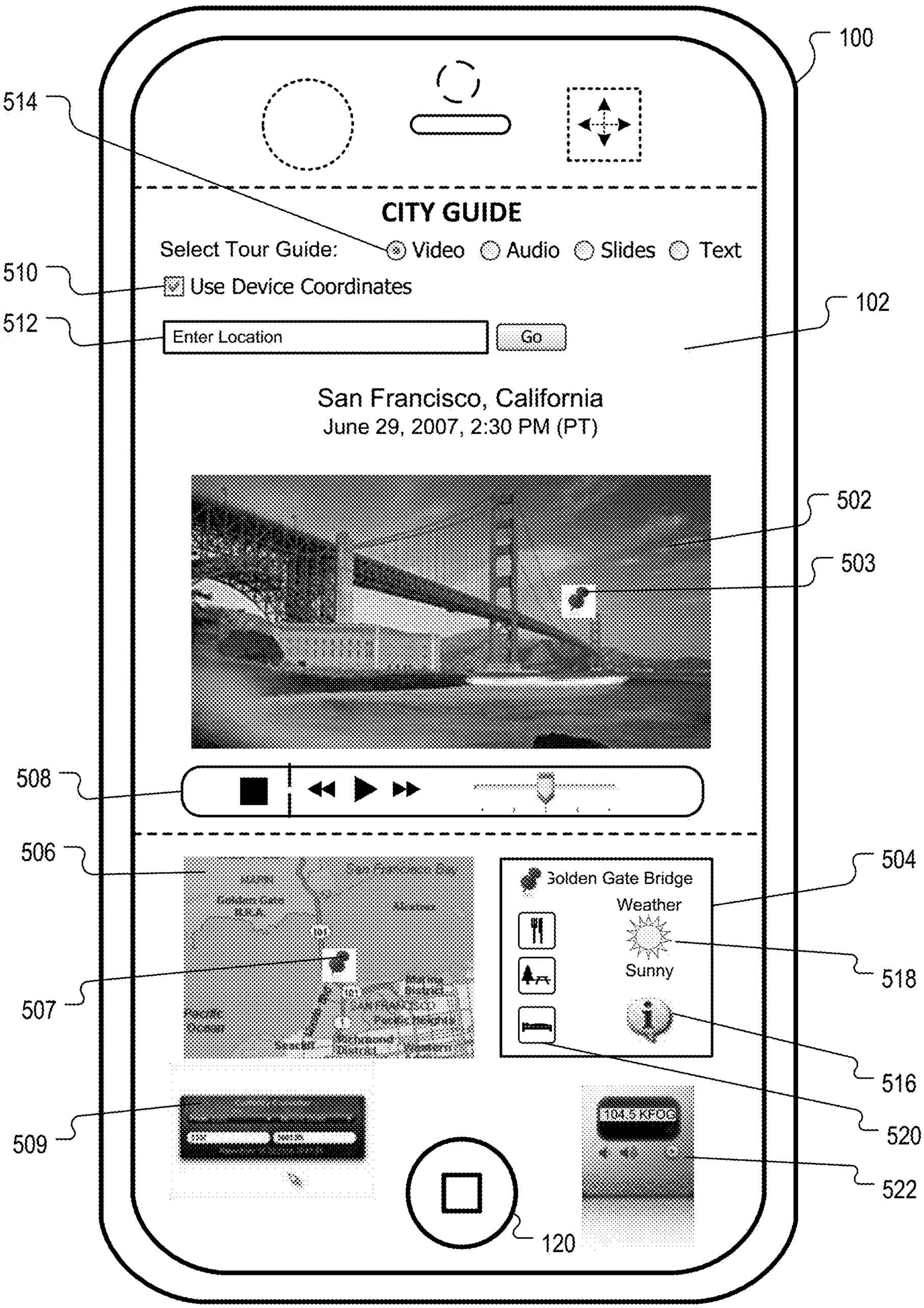
100
514
CITY GUIDE
Select Tour Guide:
Video
Audio
Slides
Text
510
Use Device Coordinates
512
Enter Location
Go
102
San Francisco, California
June 29, 2007, 2:30 PM (PT)
502
503
508
506
504
Golden Gate Bridge
Weather
Sunny
518
507
516
509
520
104.5 KFOG
522
120

FIG. 5

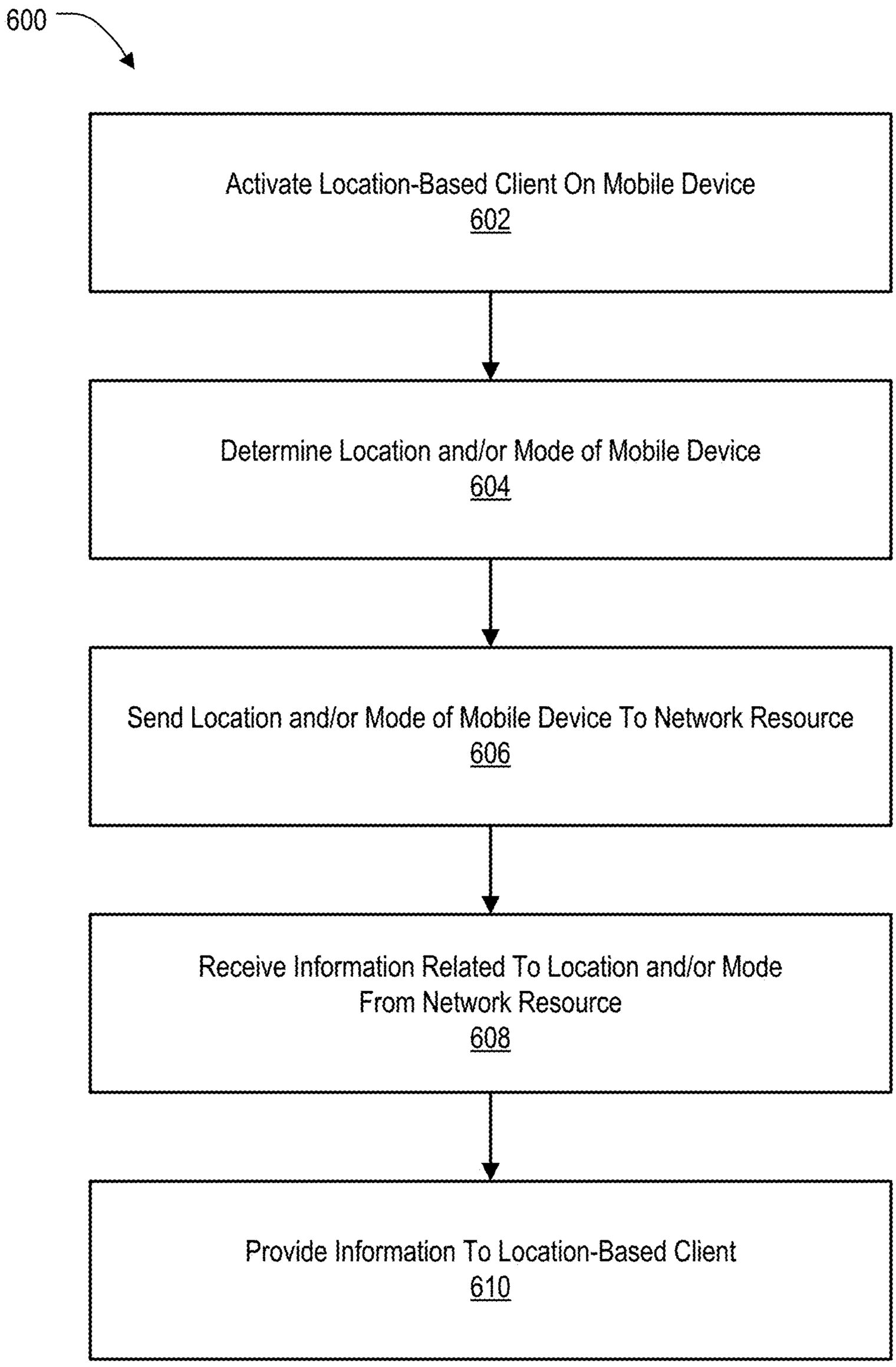
600
Activate Location-Based Client On Mobile Device
602
Determine Location and/or Mode of Mobile Device
604
Send Location and/or Mode of Mobile Device To Network Resource
606
Receive Information Related To Location and/or Mode From Network Resource
608
Provide Information To Location-Based Client
610

FIG. 6

LOCATION-AWARE MOBILE DEVICE

RELATED APPLICATIONS

This application is a continuation of co-pending U.S. application Ser. No. 16/111,329, filed Aug. 24, 2018, which is a continuation of U.S. application Ser. No. 15/435,473, filed Feb. 17, 2017, now U.S. Pat. No. 10,064,158, issued Aug. 28, 2018, which is a continuation of U.S. application Ser. No. 15/142,343, filed Apr. 29, 2016, now U.S. Pat. No. 9,578,621, issued Feb. 21, 2017, which is a continuation of U.S. application Ser. No. 14/745,638, filed Jun. 22, 2015, now U.S. Pat. No. 9,414,198, issued Aug. 9, 2016, which is a continuation of U.S. application Ser. No. 12/163,858, filed Jun. 27, 2008, now U.S. Pat. No. 9,066,199, issued Jun. 23, 2015, which claims the benefit of priority from U.S. Patent Application No. 60/946,774, filed Jun. 28, 2007. All of these applications are hereby incorporated herein by reference in their entirety.

TECHNICAL FIELD

The subject matter of this patent application is generally related to mobile devices.

BACKGROUND

Conventional mobile devices are often dedicated to performing a specific application. For example, a mobile phone provides telephony services, a personal digital assistant (PDA) provides a way to organize addresses, contacts and notes, a media player plays content, email devices provide email communication, etc. Modern mobile devices can include two or more of these applications. Due to the size limitation of a typical mobile device, such mobile devices may need to rely on a network or other remote services to support these multiple applications. For example, a map service may provide maps to a mobile device over a network, which can be used with one or more applications running on the mobile device. The introduction of a positioning system integrated with, or coupled to, the mobile device provides additional opportunities for providing location-based services.

SUMMARY

One or more location-based clients can be activated on a mobile device for providing location-based services. The location-based clients can be provided with information (e.g., presets, defaults) related to the current location and/or mode of the mobile device. The information can be obtained from one or more network resources. In some implementations, a number of location-based clients can run concurrently on the mobile device and share information.

In some implementations, a method includes: activating a first location-based client on a mobile device; determining a location of the mobile device; determining a mode associated with the device; transmitting the location and mode to a network resource; receiving information related to the location and mode from the network resource; and providing the information to the first location-based client.

In some implementations, a method includes: receiving a location of a mobile device; receiving a mode associated with the mobile device; identifying information related to the location and the mode; and transmitting the information to the mobile device.

Other implementations are disclosed which are directed to systems, methods and computer-readable mediums.

DESCRIPTION OF DRAWINGS

FIG. **1** is a block diagram of an example mobile device.

FIG. **2** is a block diagram of an example network operating environment for the mobile device of FIG. **1**.

FIG. **3** is a block diagram of an example implementation of the mobile device of FIG. **1**.

FIG. **4**A illustrates an example implementation of a software stack for the mobile device of FIG. **1**

FIG. **4**B illustrates an example implementation of a security process for remote access management over a secure communications channel.

FIG. **5** is a block diagram of an example of a mobile device running location-based clients.

FIG. **6** is a flow diagram of a process for providing location-based information to location-based clients.

DETAILED DESCRIPTION

FIG. **1** is a block diagram of an example mobile device **100**. The mobile device **100** can be, for example, a handheld computer, a personal digital assistant, a cellular telephone, a network appliance, a camera, a smart phone, an enhanced general packet radio service (EGPRS) mobile phone, a network base station, a media player, a navigation device, an email device, a game console, or other electronic device or a combination of any two or more of these devices.

Mobile Device Overview

In some implementations, the mobile device **100** includes a touch-sensitive display **102**. The touch-sensitive display **102** can implement liquid crystal display (LCD) technology, light emitting polymer display (LPD) technology, or some other display technology. The touch-sensitive display **102** can be sensitive to haptic and/or tactile contact with a user.

In some implementations, the touch-sensitive display **102** can comprise a multi-touch-sensitive display **102**. A multi-touch-sensitive display **102** can, for example, process multiple simultaneous touch points, including processing data related to the pressure, degree and/or position of each touch point. Such processing facilitates gestures and interactions with multiple fingers, chording, and other interactions. Other touch-sensitive display technologies can also be used, e.g., a display in which contact is made using a stylus or other pointing device. Some examples of multi-touch-sensitive display technology are described in U.S. Pat. Nos. 6,323,846, 6,570,557, 6,677,932, and U.S. Patent Publication 2002/0015024A1, each of which is incorporated by reference herein in its entirety.

In some implementations, the mobile device **100** can display one or more graphical user interfaces on the touch-sensitive display **102** for providing the user access to various system objects and for conveying information to the user. In some implementations, the graphical user interface can include one or more display objects **104**, **106**. In the example shown, the display objects **104**, **106**, are graphic representations of system objects. Some examples of system objects include device functions, applications, windows, files, alerts, events, or other identifiable system objects.

Example Mobile Device Functionality

In some implementations, the mobile device **100** can implement multiple device functionalities, such as a tele-

phony device, as indicated by a phone object **110**; an e-mail device, as indicated by the e-mail object **112**; a network data communication device, as indicated by the Web object **114**; a Wi-Fi base station device (not shown); and a media processing device, as indicated by the media player object **116**. In some implementations, particular display objects **104**, e.g., the phone object **110**, the e-mail object **112**, the Web object **114**, and the media player object **116**, can be displayed in a menu bar **118**. In some implementations, device functionalities can be accessed from a top-level graphical user interface, such as the graphical user interface illustrated in FIG. **1**. Touching one of the objects **110**, **112**, **114** or **116** can, for example, invoke corresponding functionality.

In some implementations, the mobile device **100** can implement network distribution functionality. For example, the functionality can enable the user to take the mobile device **100** and its associated network while traveling. In particular, the mobile device **100** can extend Internet access (e.g., Wi-Fi) to other wireless devices in the vicinity. For example, mobile device **100** can be configured as a base station for one or more devices. As such, mobile device **100** can grant or deny network access to other wireless devices.

In some implementations, upon invocation of device functionality, the graphical user interface of the mobile device **100** changes, or is augmented or replaced with another user interface or user interface elements, to facilitate user access to particular functions associated with the corresponding device functionality. For example, in response to a user touching the phone object **110**, the graphical user interface of the touch-sensitive display **102** may present display objects related to various phone functions; likewise, touching of the email object **112** may cause the graphical user interface to present display objects related to various e-mail functions; touching the Web object **114** may cause the graphical user interface to present display objects related to various Web-surfing functions; and touching the media player object **116** may cause the graphical user interface to present display objects related to various media processing functions.

In some implementations, the top-level graphical user interface environment or state of FIG. **1** can be restored by pressing a button **120** located near the bottom of the mobile device **100**. In some implementations, each corresponding device functionality may have corresponding "home" display objects displayed on the touch-sensitive display **102**, and the graphical user interface environment of FIG. **1** can be restored by pressing the "home" display object.

In some implementations, the top-level graphical user interface can include additional display objects **106**, such as a short messaging service (SMS) object **130**, a calendar object **132**, a photos object **134**, a camera object **136**, a calculator object **138**, a stocks object **140**, a weather object **142**, a maps object **144**, a city guide object **146**, a clock object **148**, an address book object **150**, and a settings object **152**. Touching the SMS display object **130** can, for example, invoke an SMS messaging environment and supporting functionality; likewise, each selection of a display object **134**, **136**, **138**, **140**, **142**, **144**, **146**, **148**, **150** and **152** can invoke a corresponding object environment and functionality.

Additional and/or different display objects can also be displayed in the graphical user interface of FIG. **1**. For example, if the device **100** is functioning as a base station for other devices, one or more "connection" objects may appear in the graphical user interface to indicate the connection. In some implementations, the display objects **106** can be configured by a user, e.g., a user may specify which display objects **106** are displayed, and/or may download additional applications or other software that provides other functionalities and corresponding display objects.

In some implementations, the mobile device **100** can include one or more input/output (I/O) devices and/or sensor devices. For example, a speaker **160** and a microphone **162** can be included to facilitate voice-enabled functionalities, such as phone and voice mail functions. In some implementations, a loud speaker **164** can be included to facilitate hands-free voice functionalities, such as speaker phone functions. An audio jack **166** can also be included for use of headphones and/or a microphone.

In some implementations, a proximity sensor **168** can be included to facilitate the detection of the user positioning the mobile device **100** proximate to the user's ear and, in response, to disengage the touch-sensitive display **102** to prevent accidental function invocations. In some implementations, the touch-sensitive display **102** can be turned off to conserve additional power when the mobile device **100** is proximate to the user's ear.

Other sensors can also be used. For example, in some implementations, an ambient light sensor **170** can be utilized to facilitate adjusting the brightness of the touch-sensitive display **102**. In some implementations, an accelerometer **172** can be utilized to detect movement of the mobile device **100**, as indicated by the directional arrow **174**. Accordingly, display objects and/or media can be presented according to a detected orientation, e.g., portrait or landscape. In some implementations, the mobile device **100** may include circuitry and sensors for supporting a location determining capability, such as that provided by the global positioning system (GPS) or other positioning systems (e.g., systems using Wi-Fi access points, television signals, cellular grids, Uniform Resource Locators (URLs)). In some implementations, a positioning system (e.g., a GPS receiver) can be integrated into the mobile device **100** or provided as a separate device that can be coupled to the mobile device **100** through an interface (e.g., port device **190**) to provide access to location-based services.

The mobile device **100** can also include a camera lens and sensor **180**. In some implementations, the camera lens and sensor **180** can be located on the back surface of the mobile device **100**. The camera can capture still images and/or video.

The mobile device **100** can also include one or more wireless communication subsystems, such as a 802.11b/g communication device **186**, and/or a Bluetooth™ communication device **188**. Other communication protocols can also be supported, including other 802.x communication protocols (e.g., WiMax, Wi-Fi, 3G), code division multiple access (CDMA), global system for mobile communications (GSM), Enhanced Data GSM Environment (EDGE), etc.

In some implementations, a port device **190**, e.g., a Universal Serial Bus (USB) port, or a docking port, or some other wired port connection, can be included. The port device **190** can, for example, be utilized to establish a wired connection to other computing devices, such as other communication devices **100**, network access devices, a personal computer, a printer, or other processing devices capable of receiving and/or transmitting data. In some implementations, the port device **190** allows the mobile device **100** to synchronize with a host device using one or more protocols, such as, for example, the TCP/IP, HTTP, UDP and any other known protocol.

Network Operating Environment

FIG. **2** is a block diagram of an example network operating environment **200** for the mobile device **100** of FIG. **1**.

The mobile device **100** of FIG. **1** can, for example, communicate over one or more wired and/or wireless networks **210** in data communication. For example, a wireless network **212**, e.g., a cellular network, can communicate with a wide area network (WAN) **214**, such as the Internet, by use of a gateway **216**. Likewise, an access point **218**, such as an 802.11g wireless access point, can provide communication access to the wide area network **214**. In some implementations, both voice and data communications can be established over the wireless network **212** and the access point **218**. For example, the mobile device **100***a* can place and receive phone calls (e.g., using VoIP protocols), send and receive e-mail messages (e.g., using POP3 protocol), and retrieve electronic documents and/or streams, such as web pages, photographs, and videos, over the wireless network **212**, gateway **216**, and wide area network **214** (e.g., using TCP/IP or UDP protocols). Likewise, the mobile device **100***b* can place and receive phone calls, send and receive e-mail messages, and retrieve electronic documents over the access point **218** and the wide area network **214**. In some implementations, the mobile device **100** can be physically connected to the access point **218** using one or more cables and the access point **218** can be a personal computer. In this configuration, the mobile device **100** can be referred to as a "tethered" device.

The mobile devices **100***a* and **100***b* can also establish communications by other means. For example, the wireless device **100***a* can communicate with other wireless devices, e.g., other wireless devices **100**, cell phones, etc., over the wireless network **212**. Likewise, the mobile devices **100***a* and **100***b* can establish peer-to-peer communications **220**, e.g., a personal area network, by use of one or more communication subsystems, such as the Bluetooth™ communication device **188** shown in FIG. **1**. Other communication protocols and topologies can also be implemented.

The mobile device **100** can, for example, communicate with one or more services **230**, **240**, **250**, **260**, **270** over the one or more wired and/or wireless networks **210**. For example, a navigation service **230** can provide navigation information, e.g., map information, location information, route information, and other information, to the mobile device **100**. In the example shown, a user of the mobile device **100***b* has invoked a map functionality, e.g., by pressing the maps object **144** on the top-level graphical user interface shown in FIG. **1**, and has requested and received a map for the location "1 Infinite Loop, Cupertino, Calif."

A messaging service **240** can, for example, provide e-mail and/or other messaging services. A media service **250** can, for example, provide access to media files, such as song files, movie files, video clips, and other media data. A syncing service **260** can, for example, perform syncing services (e.g., sync files). An activation service **270** can, for example, perform an activation process **500** for activating the mobile device **100**, as described in reference to FIG. **5**. Other services can also be provided, including a software update service that automatically determines whether software updates exist for software on the mobile device **100**, then downloads the software updates to the mobile device **100** where it can be manually or automatically unpacked and/or installed.

The mobile device **100** can also access other data and content over the one or more wired and/or wireless networks **210**. For example, content publishers, such as news sites, RSS feeds, web sites, blogs, social networking sites, developer networks, etc., can be accessed by the mobile device **100**. Such access can be provided by invocation of a web browsing function or application (e.g., a browser) in response to a user touching the Web object **114**.

Example Mobile Device Architecture

FIG. **3** is a block diagram **300** of an example implementation of the mobile device **100** of FIG. **1**. The mobile device **100** can include a memory interface **302**, one or more data processors, image processors and/or central processing units **304**, and a peripherals interface **306**. The memory interface **302**, the one or more processors **304** and/or the peripherals interface **306** can be separate components or can be integrated in one or more integrated circuits. The various components in the mobile device **100** can be coupled by one or more communication buses or signal lines.

Sensors, devices and subsystems can be coupled to the peripherals interface **306** to facilitate multiple functionalities. For example, a motion sensor **310**, a light sensor **312**, and a proximity sensor **314** can be coupled to the peripherals interface **306** to facilitate the orientation, lighting and proximity functions described with respect to FIG. **1**. Other sensors **316** can also be connected to the peripherals interface **306**, such as a positioning system (e.g., GPS receiver), a temperature sensor, a biometric sensor, or other sensing device, to facilitate related functionalities.

A camera subsystem **320** and an optical sensor **322**, e.g., a charged coupled device (CCD) or a complementary metal-oxide semiconductor (CMOS) optical sensor, can be utilized to facilitate camera functions, such as recording photographs and video clips.

Communication functions can be facilitated through one or more wireless communication subsystems **324**, which can include radio frequency receivers and transmitters and/or optical (e.g., infrared) receivers and transmitters. The specific design and implementation of the communication subsystem **324** can depend on the communication network(s) over which the mobile device **100** is intended to operate. For example, a mobile device **100** may include communication subsystems **324** designed to operate over a GSM network, a GPRS network, an EDGE network, a Wi-Fi or WiMax network, and a Bluetooth™ network. In particular, the wireless communication subsystems **324** may include hosting protocols such that the device **100** may be configured as a base station for other wireless devices.

An audio subsystem **326** can be coupled to a speaker **328** and a microphone **330** to facilitate voice-enabled functions, such as voice recognition, voice replication, digital recording, and telephony functions.

The I/O subsystem **340** can include a touch screen controller **342** and/or other input controller(s) **344**. The touch screen controller **342** can be coupled to a touch screen **346**. The touch screen **346** and touch screen controller **342** can, for example, detect contact and movement or break thereof using any of a plurality of touch sensitivity technologies, including but not limited to capacitive, resistive, infrared, and surface acoustic wave technologies, as well as other proximity sensor arrays or other elements for determining one or more points of contact with the touch screen **346**.

The other input controller(s) **344** can be coupled to other input/control devices **348**, such as one or more buttons, rocker switches, thumb-wheel, infrared port, USB port, and/or a pointer device such as a stylus. The one or more buttons (not shown) can include an up/down button for volume control of the speaker **328** and/or the microphone **330**.

In one implementation, a pressing of the button for a first duration may disengage a lock of the touch screen **346**; and

a pressing of the button for a second duration that is longer than the first duration may turn power to the mobile device **100** on or off. The user may be able to customize a functionality of one or more of the buttons. The touch screen **346** can, for example, also be used to implement virtual or soft buttons and/or a keypad or keyboard.

In some implementations, the mobile device **100** can present recorded audio and/or video files, such as MP3, AAC, and MPEG files. In some implementations, the mobile device **100** can include the functionality of an MP3 player, such as an iPod™. The mobile device **100** may, therefore, include a 36-pin connector that is compatible with the iPod. Other input/output and control devices can also be used.

The memory interface **302** can be coupled to memory **350**. The memory **350** can include high-speed random access memory and/or non-volatile memory, such as one or more magnetic disk storage devices, one or more optical storage devices, and/or flash memory (e.g., NAND, NOR). The memory **350** can store an operating system **352**, such as Darwin, RTXC, LINUX, UNIX, OS X, WINDOWS, or an embedded operating system such as VxWorks. The operating system **352** may include instructions for handling basic system services and for performing hardware dependent tasks. In some implementations, the operating system **352** can be a kernel (e.g., UNIX kernel), as described in reference to FIGS. **4**A and **4**B.

The memory **350** may also store communication instructions **354** to facilitate communicating with one or more additional devices, one or more computers and/or one or more servers. The memory **350** may include graphical user interface instructions **356** to facilitate graphic user interface processing; sensor processing instructions **358** to facilitate sensor-related processing and functions; phone instructions **360** to facilitate phone-related processes and functions; electronic messaging instructions **362** to facilitate electronic-messaging related processes and functions; web browsing instructions **364** to facilitate web browsing-related processes and functions; media processing instructions **366** to facilitate media processing-related processes and functions; GPS/Navigation instructions **368** to facilitate GPS and navigation-related processes and instructions; camera instructions **370** to facilitate camera-related processes and functions; and/or other software instructions **372** to facilitate processes and functions, as described in reference to FIGS. **4-6**. As described below, an activation record and IMEI or similar hardware identifier **374** can also be stored in memory **350**.

Each of the above identified instructions and applications can correspond to a set of instructions for performing one or more functions described above. These instructions need not be implemented as separate software programs, procedures or modules. The memory **350** can include additional instructions or fewer instructions. Furthermore, various functions of the mobile device **100** may be implemented in hardware and/or in software, including in one or more signal processing and/or application specific integrated circuits.

Software Stack and Security Process

FIG. **4**A illustrates an example implementation of a software stack **400** for the mobile device of FIG. **1**. In some implementations, the software stack **400** includes an operating system (OS) kernel **402** (e.g., a UNIX kernel), a library system **404**, an application framework **406** and an application layer **408**.

The OS kernel **402** manages the resources of the mobile device **100** and allows other programs to run and use these resources. Some examples of resources include a processor, memory and I/O. For example, the kernel **402** can determine which running processes should be allocated to a processor, processors or processor cores, allocates memory to the processes and allocates requests from applications and remote services to perform I/O operations. In some implementations, the kernel **402** provides methods for synchronization and inter-process communications with other devices.

In some implementations, the kernel **402** can be stored in non-volatile memory of the mobile device **100**. When the mobile device **100** is turned on, a boot loader starts executing the kernel **402** in supervisor mode. The kernel then initializes itself and starts one or more processes for the mobile device **100**, including a remote access process **404***b* for remote access management, as described in reference to FIG. **4**B.

The library system **404** provides various services applications running in the application layer **408**. Such services can include audio services, video services, database services, image processing services, graphics services, location-based services, etc.

The application framework **406** provides an object-oriented application environment including classes and Application Programming Interfaces (APIs) that can be used by developers to build applications using well-known programming languages (e.g., Objective-C, Java).

The applications layer **408** is where various applications exist in the software stack **400**. Developers can use the APIs and environment provided by the application framework **406** to build applications, such as the applications represented by the display objects **104**, **106**, shown in FIG. **1** (e.g., email, media player, Web browser, phone).

In some implementations, the applications layer **408** includes one or more location-based clients (e.g., applications, widgets). In the example shown, the applications layer **408** includes a City Guide client **408***a*, a currency converter client **408***b*, a radio client **408***c* and a world clock client **408***n*. Other location-based clients are possible, such as an information directory client (e.g., "Yellow Pages"), a music client, a weather client, a sports client, a movie/television client, a tidal watch client, a golf helper client, etc. Each of these location-based clients will be described in more detail in reference to FIGS. **5** and **6**.

In some implementations, the location-based clients **408***a-n* can make calls to various services provided by the library system **404**. The services can be accessed by the clients **408***a-n* through the application framework **406**, for example. In the example shown, the library system **404** includes a location server **404***a* and a remote access process **404***b*. The location server **404***a* is a server process that communicates with a positioning system (e.g., a GPS receiver integrated or coupled to the mobile device **100**) and serves the current position coordinates of the mobile device to the location-based clients **408***a-n* in response to a client request or other trigger event. In some implementations, the position coordinates are stored in a location in memory **350** (e.g., a reserved memory location), which can be accessed by clients **408***a-n*. The location server **404***a* can refresh the location in memory **350** on a periodic basis or in response to a trigger event.

Secure Communication Channel

FIG. **4**B illustrates an example implementation of the remote access process **404***b* for remote access management over a communications channel **422** (e.g., a secure commu-

nications channel). In the example shown, the mobile device **100** is running the remote access process **404***b*, which communicates with the OS kernel **402**. Any remote access requests made to the kernel **402** are intercepted by the process **404***b*, which is responsible for setting up communication sessions between the mobile device **100** and mobile services access device. In some implementations, the process **404***b* uses a cryptographic protocol, such as Secure Sockets Layer (SSL) or Transport Layer Security (TLS) to provide secure communication sessions between the mobile device **100** and an access point **218**. The access point **218** can be any device with network connectivity, including but not limited to: a personal computer, a hub, an Ethernet card, another mobile device, a wireless base station, etc. The secure communications channel can be a Universal Serial Bus (USB), Ethernet, a wireless link (e.g., Wi-Fi, WiMax, 3G), an optical link, infrared link, FireWire™, or any other known communications channel or media.

In the example shown, the access point **218** includes device drivers **414**, a mobile services daemon **416**, a mobile services API **418** and one or more mobile service applications **420**. The device drivers **414** are responsible for implementing a transport layer protocol, such as TCP/IP over USB. The mobile services daemon **416** listens (e.g. continuously) to the communications channel **422** for activity and manages the transmission of commands and data over the communication channel **422**. The mobile services API **418** provides a set of functions, procedures, variables and data structures for supporting requests for services made by the mobile services application **420**. The mobile services application **420** can be a client program running on the access point, which provides one or more user interfaces for allowing a user to interact with a remote service (e.g., activation service **270**) over a network (e.g., the Internet, wireless network, peer-to-peer network, optical network, Ethernet, intranet). The application **420** can allow a user to set preferences, download or update files of content or software, search databases, store user data, select services, browse content, perform financial transactions, or engage in any other online service or function. An example of a mobile services application **420** is the iTunes™ client, which is publicly available from Apple, Inc. (Cupertino, Calif.). An example of mobile device **100** that uses the iTunes™ client is the iPod™ product developed by Apple Inc.

In an example operational mode, a user connects the mobile device **100** to the mobile access point using, for example, a USB cable. In other implementations, the mobile device **100** and access point **218** include wireless transceivers for establishing a wireless link (e.g., Wi-Fi). The drivers **414** and kernel **402** detect the connection and alert the remote access process **404***b* and mobile services daemon **416** of the connection status. Once the connection is established certain non-sensitive information can be passed from the mobile device **100** to the access point **218** (e.g., name, disk size, activation state) to assist in establishing a secure communication session.

In some implementations, the remote access process **404***b* establishes a secure communication session (e.g., encrypted SSL session) with the access point **218** by implementing a secure network protocol. For example, if using SSL protocol, the mobile device **100** and access point **218** will negotiate a cipher suite to be used during data transfer, establish and share a session key, and authenticate the access point **218** to the mobile device **100**. In some implementations, if the mobile device **100** is password protected, the process **404***b* will not establish a session, and optionally alert the user of the reason for failure.

Once a secure session is successfully established, the mobile device **100** and the access point **218** can exchange sensitive information (e.g., passwords, personal information), and remote access to the mobile device **100** can be granted to one or more services (e.g., navigation service **230**, messaging service **240**, media service **250**, syncing service **260**, activation service **270**). In some implementations, the mobile services daemon **416** multiplexes commands and data for transmission over the communication channel **422**. This multiplexing allows several remote services to have access to the mobile device **100** in a single session without the need to start a new session (or handshaking) for each service requesting access to the mobile device **100**.

Location-Based Clients

FIG. **5** is a block diagram of an example of a mobile device **100** running location-based clients. In the example shown, the mobile device **100** is running a City Guide client, and the mobile device **100** is located in San Francisco. The City Guide client presents various information related to San Francisco on the touch-sensitive display **102**. In this example, the user selected a "Use Device Coordinates" option **510**. Selecting this option engages a positioning system (e.g., a GPS receiver) that automatically determines the geographic location of the mobile device **100**. In other implementations, the user can enter a location of interest in a search box **512**.

In some implementations, the City Guide client allows a user to select one of four city guide modes: video mode **514**, audio mode, slide mode and text mode. In this example, the user selected the video mode **514**. The video mode **514** provides a video tour of San Francisco using a video display **502**, which can be controlled by the user with video controls **508**. In some implementations, placemarks (e.g., pushpins) are overlaid on the video at locations for which there is additional information available. The additional information can be presented on the touch-sensitive display **102** in a variety of ways, including as a map **506** or through a directory **504** or other user interface element or control (e.g., a menu system). In the example shown, the location currently shown in the video display **502** is the Golden Gate Bridge, which is marked with pushpin **503**. The location is also marked on the map **506** with a corresponding pushpin **507**. Some examples of locations that could be represented on a map by placemarks include businesses (e.g., restaurants, lodging), services (e.g., hospitals, police) and attractions (e.g., parks, picnic areas, monuments).

The directory **504** can include several user interface elements that can be selected (e.g., touched by a finger or stylus) to provide additional information related to the location marked by the pushpins **503** and **507**, which in this example is the Golden Gate Bridge. In some implementations, the directory **504** can include user interface elements (e.g., buttons) that can be selected to display information about restaurants, lodging, parks, picnic areas, and/or businesses in the vicinity of the Golden Gate Bridge. The current weather **518** can also be shown, or any other information **516** relevant to the current location of the mobile device **100**. In some implementations, advertisements for products or services related to the location and/or a mode (e.g., video mode) of the mobile device **100** can be presented on the mobile device **100** using display means (e.g., the touch-sensitive display **102**) and/or audio means (e.g., a ring tone, text-to-speech, voicemail, an audio file).

Other city guide modes can also be selected by the user. For example, an audio mode can be selected to provide an

audio tour of San Francisco, a slide mode can be selected to provide a slide show of San Francisco and a text mode can be selected to provide an electronic guide book of San Francisco. In some implementations, one or more modes can be combined to provide a multimedia presentation.

An advantage of the implementation just described is the ability of location-based clients to share information. In the example shown, the device coordinates were provided by the location server **404***a*. In some implementations, when the user selects the video mode **514**, the mobile device **100** establishes a communication session with a remote service (e.g., a server) over a communications channel (e.g., wired or wireless link). The mobile device **100** provides the service with the position coordinates of the mobile device **100** and the service returns video, map and directory information to the mobile device **100**, where it can be used by one or more location-based clients. In some implementations, the service provides presets or default values for loading into one or more location-based clients. As the user navigates the video guide with the controls **508**, information regarding the current location is shared with a map service for rendering the map **506**, and for determining which information to list in the directory **504**.

Other location-based clients include a currency converter **509** which can be loaded with a preset for converting currency based on the location of the mobile device **100**. In this example, the currency converter **509** allows the user to convert from a desired foreign currency to U.S. currency, or vice-versa. Another client can be a radio client **522** for streaming music by local artists and providing local concert information. The radio client could be loaded with presets for local radio stations. A "Yellow Pages" client could be loaded with local listings. A weather client could be loaded with local weather conditions, a world clock client could be loaded with the local time, a tidal watch client could be loaded with local tide tables (e.g., for use by surfers and fisherman), a golf helper client could be loaded with information about local golf courses (e.g., notes about the course conditions, pars, and strategies for playing the holes). All or some of these clients can operate on the mobile device **100** either alone or concurrently with other clients and share information. In some implementations, information from a first client can be used to change properties or attributes of a second location-based client (e.g., change a user interface associated with a client). In some implementations, activating a first location-based client causes a second location-based client to activate.

In some implementations, the user can interact with the clients and leave information which can be uploaded from the mobile device **100** to the service, where it can be accessed by or shared with other users. For example, the user could touch a pushpin **503**, **507**, and be provided with information regarding the location marked by the pushpin, **503**, **507**. Additionally, a text box or other input mechanism can be presented for allowing the user to enter information or attach content (e.g., digital photos), which can be sent to the service.

FIG. **6** is a flow diagram of a process **600** for providing location-based information (e.g., presets, defaults) to location-based clients. The process **600** begins when a location-based client is activated on the mobile device (**602**). The client can be activated manually by the user through, for example, the touch-sensitive display **102**, or automatically by another client or trigger event.

The location and/or a mode of the mobile device is determined (**604**). The location (e.g., latitude, longitude) can be determined by a positioning system integrated in, or coupled to, the mobile device. The location can be determined independent of whether any client is currently active. The location and/or mode can be transmitted to one or more network resources (**606**). The network resources can use the location and/or mode to identify relevant information to send to the mobile device. In some implementations, the information can be selected based on the type of location-based client requesting the information.

A mode can indicate a state of the device or a context based on user activity. For example, if the user is browsing the web with the mobile device **100**, then the mobile device **100** can provide a context mode descriptor to the service indicating that the user is currently in a browsing mode. The descriptor can also include search terms, a current web page URL, historical browsing patterns (e.g., URLs of cached web pages), bookmarks, etc. The service can use the descriptor to provide location-based services and/or content. In another example, if the user is taking digital pictures with the mobile device **100** (e.g., a camera integrated with a mobile phone), then the mobile device **100** can send a state mode descriptor to the service indicating that the user is currently taking a digital picture. The service can use the descriptor to provide location-based service, such a link to a camera store or a website where the user can upload and share their photos. In another example, an audio mode descriptor can be set to the service for indicating that the user is currently listening to music (e.g., operating an MP3 player). The service can use the audio mode descriptor to provide location-based services and/or content related to music. The audio mode descriptor could also include information about the song being played, such as title, artist, genre, etc.

The information is received by the mobile device (**608**), and provided to the location-based client requesting the information (**610**). In some implementations, the information can be updated periodically or in response to a trigger event while the location-based client is in operation.

In some implementations, each location-based client has a unique identifier that can be sent to the service, so that the service knows the type of client that will be using the information. In the example shown, the mobile device **100** can send one or more identifiers or descriptors to the service that indicate that the user is running a City Guide location-based client and that a video mode **514** has been selected. The service can then use the identifiers and the location information to download a video city guide for San Francisco.

In some implementations, a mobile device connected to a communications network may download a "tour" which is an association of data and locations. For example, a set of video, music, spoken or text content associated with various points on a path such as a road or trail for education, tourism, recreation, etc. In some implementations, a set of speeds or other vehicle related recommendations can also be downloaded. The recommendations can include, for example, suggested gear shifts associated with specific road segments for energy efficient driving and safety.

In some implementations, a mobile device in association with a location aware system (e.g., GPS, accelerometer, inertial measurement unit) can play data or content associated with a path or road as a tour is traveled by a person or vehicle. For example, video, music, spoken or text content may be presented as the user moves through the associated locations on a walk or drive. Alternatively, the vehicle related settings and recommendations (e.g., gear position, speed) may be displayed or presented as the vehicle moves through the various segments of the drive. In this embodi-

ment, real time data from the vehicle (e.g., remaining charge, remaining fuel, etc.) may be used to fine tune or adjust the recommendations for the rest of the path traveled. Vehicle equipment can be used as a display system or presentation system. For example, the vehicle's GPS or other console can be used to display video or text and the vehicle's speaker system can be used to play audio. The mobile device can communicate tour data and content to vehicle equipment through a wired or wireless link (e.g., cable, Bluetooth link).

In some implementations, an accelerometer based system with a processor and a memory can improve location estimates during, for example, a walking or driving tour. Given an accurate start point and a route, the system can determine that a particular path or route is being followed based on detection of turns and direction of turns. As the vehicle or user moves up and down over highway ramps, major dips in the road, bridges, etc., the accelerometer can detect changes in vertical velocity and map a vertical velocity change profile of the vehicle to one of several possible routes. The velocity change profile can be combined with the turn information and/or GPS or other positioning technology (e.g., Wi-Fi, cell tower triangulation) to improve location estimates for the vehicle.

In some implementations, a tour's content may change depending on the direction and speed of the mobile device **100**. For example, if a user is heading North, the mobile device **100** may present the user with material for destinations that the user is about to reach. Thus, in addition to receiving content based on current location, the service can determine (e.g., predict) the user's future locations based on sensor data, route traveled, landmarks, etc., and provide location-based services and/or content based on those future locations. In some implementations, the way content is presented to a user can change based on user's travel speed. For example, a speedy traveler could receive heading pages for prior saved media and a strolling traveler could see a complete presentation.

The features described can be implemented in digital electronic circuitry, or in computer hardware, firmware, software, or in combinations of them. The features can be implemented in a computer program product tangibly embodied in an information carrier, e.g., in a machine-readable storage device or in a propagated signal, for execution by a programmable processor; and method steps can be performed by a programmable processor executing a program of instructions to perform functions of the described implementations by operating on input data and generating output.

After the mobile device is activated, in some implementations the remote access process **404***b* monitors remote access requests and sets-up and tears-down secure sessions as needed. Thus, in such an implementation all remote access requests are managed by a single remote access process **404***b*. If a user alters the mobile device (e.g., changing a SIM card), the remote access process **404***b* will detect the change and initiate an action, such as starting a new activation process **500**, **600**.

The described features can be implemented advantageously in one or more computer programs that are executable on a programmable system including at least one programmable processor coupled to receive data and instructions from, and to transmit data and instructions to, a data storage system, at least one input device, and at least one output device. A computer program is a set of instructions that can be used, directly or indirectly, in a computer to perform a certain activity or bring about a certain result. A computer program can be written in any form of programming language (e.g., Objective-C, Java), including compiled or interpreted languages, and it can be deployed in any form, including as a stand-alone program or as a module, component, subroutine, or other unit suitable for use in a computing environment.

Suitable processors for the execution of a program of instructions include, by way of example, both general and special purpose microprocessors, and the sole processor or one of multiple processors or cores, of any kind of computer. Generally, a processor will receive instructions and data from a read-only memory or a random access memory or both. The essential elements of a computer are a processor for executing instructions and one or more memories for storing instructions and data. Generally, a computer will also include, or be operatively coupled to communicate with, one or more mass storage devices for storing data files; such devices include magnetic disks, such as internal hard disks and removable disks; magneto-optical disks; and optical disks. Storage devices suitable for tangibly embodying computer program instructions and data include all forms of non-volatile memory, including by way of example semiconductor memory devices, such as EPROM, EEPROM, and flash memory devices; magnetic disks such as internal hard disks and removable disks; magneto-optical disks; and CD-ROM and DVD-ROM disks. The processor and the memory can be supplemented by, or incorporated in, ASICs (application-specific integrated circuits).

To provide for interaction with a user, the features can be implemented on a computer having a display device such as a CRT (cathode ray tube) or LCD (liquid crystal display) monitor for displaying information to the user and a keyboard and a pointing device such as a mouse or a trackball by which the user can provide input to the computer.

The features can be implemented in a computer system that includes a back-end component, such as a data server, or that includes a middleware component, such as an application server or an Internet server, or that includes a front-end component, such as a client computer having a graphical user interface or an Internet browser, or any combination of them. The components of the system can be connected by any form or medium of digital data communication such as a communication network. Examples of communication networks include, e.g., a LAN, a WAN, and the computers and networks forming the Internet.

The computer system can include clients and servers. A client and server are generally remote from each other and typically interact through a network. The relationship of client and server arises by virtue of computer programs running on the respective computers and having a client-server relationship to each other.

A number of implementations have been described. Nevertheless, it will be understood that various modifications may be made. For example, elements of one or more implementations may be combined, deleted, modified, or supplemented to form further implementations. As yet another example, the logic flows depicted in the figures do not require the particular order shown, or sequential order, to achieve desirable results. In addition, other steps may be provided, or steps may be eliminated, from the described flows, and other components may be added to, or removed from, the described systems. Accordingly, other implementations are within the scope of the following claims.

What is claimed is:

1. A method comprising:

determining, by a mobile device, a location of the mobile device;

transmitting, by a location-based client executed by a processor of the mobile device, a request for information corresponding to the determined location of the mobile device, the request transmitted to a network resource;

in response to the request for information, receiving, from the network resource, information that includes map content and vehicle related content associated with the location-based client, wherein the vehicle related content is based on the determined location of the mobile device;

in response to receiving the information from the network resource:

displaying the map content via a user interface of the mobile device; and

displaying the vehicle related content via the user interface of the mobile device concurrently with the map content.

2. The method of claim **1**, wherein displaying the vehicle related content via the user interface of the mobile device concurrently with the map content comprises:

presenting a map indicating the location of the mobile device;

in conjunction with presenting the map indicating the location of the mobile device, presenting an indication of the location of the mobile device and information on one or more vehicles corresponding to the location of the mobile device.

3. The method of claim **1**, wherein displaying the vehicle related content via the user interface of the mobile device concurrently with the map content comprises:

presenting a map indicating the location of the mobile device; and

in conjunction with presenting the map indicating the location of the mobile device, presenting information on vehicle-related services corresponding to the location of the mobile device.

4. The method of claim **3**, wherein presenting information on vehicle-related services corresponding to the location of the mobile device comprises:

providing information on a route followed by a first vehicle; and

predicting future locations of the first vehicle based on the route followed by the first vehicle.

5. The method of claim **1**, further comprising:

receiving information including an update to the vehicle related content; and

displaying the update to the vehicle related content via the user interface of the mobile device concurrently with the map content.

6. The method of claim **1**, further comprising:

in response to displaying the map content and the vehicle-related content, receiving a user input corresponding to the location-based client, wherein receiving the user input comprises providing an input field associated with the location-based client and receiving information entered by a user of the mobile device through the input field; and

transmitting the user input to the network resource, the network resource to share the user input with a second mobile device.

7. The method of claim **1**, further comprising:

providing a first view of map content associated with a first travel speed of the mobile device; and

providing a second view of the map content associated with a second travel speed of the mobile device.

8. A non-transitory computer-readable medium storing one or more instructions which, when executed by one or more processors, cause the one or more processors to perform operations comprising:

determining, by a mobile device, a location of the mobile device;

transmitting, by a location-based client executed by a processor of the mobile device, a request for information corresponding to the determined location of the mobile device, the request transmitted to a network resource;

in response to the request for information, receiving, from the network resource, information that includes map content and vehicle related content associated with the location-based client, wherein the vehicle related content is based on the determined location of the mobile device;

in response to receiving the information from the network resource:

displaying the map content via a user interface of the mobile device; and

displaying the vehicle related content via the user interface of the mobile device concurrently with the map content.

9. The non-transitory computer-readable medium of claim **8**, wherein displaying the vehicle related content via the user interface of the mobile device concurrently with the map content comprises:

presenting a map indicating the location of the mobile device; and

in conjunction with presenting the map indicating the location of the mobile device, presenting an indication of the location of the mobile device and information on one or more vehicles corresponding to the location of the mobile device.

10. The non-transitory computer-readable medium of claim **8**, wherein displaying the vehicle related content via the user interface of the mobile device concurrently with the map content comprises:

presenting a map indicating the location of the mobile device; and

in conjunction with presenting the map indicating the location of the mobile device, presenting information on vehicle-related services corresponding to the location of the mobile device.

11. The non-transitory computer-readable medium of claim **10**, wherein presenting information on vehicle-related services corresponding to the location of the mobile device comprises:

providing information on a route followed by a first vehicle; and

predicting future locations of the first vehicle based on the route followed by the first vehicle.

12. The non-transitory computer-readable medium of claim **8**, the operations further comprising:

receiving information including an update to the vehicle related content; and

displaying the update to the vehicle related content via the user interface of the mobile device concurrently with the map content.

13. The non-transitory computer-readable medium of claim **8**, the operations further comprising:

in response to displaying the map content and the vehicle-related content, receiving a user input corresponding to the location-based client, wherein receiving the user input comprises providing an input field associated

with the location-based client and receiving information entered by a user of the mobile device through the input field;

transmitting the user input to the network resource, the network resource to share the user input with a second mobile device.

14. The non-transitory computer-readable medium of claim **8**, the operations further comprising:

determining, a travel speed for the mobile device;

providing a first view of map content associated with a first travel speed for the mobile device; and

providing a second view of the map content associated with a second travel speed for the mobile device.

15. A mobile device comprising:

one or more processors; and

memory storing instructions which, when executed by the one or more processors, cause the one or more processors to:

determine, by the mobile device, a location of the mobile device;

transmit, by a location-based client executed by a processor of the mobile device, a request for information corresponding to the determined location of the mobile device, the request transmitted to a network resource;

in response to the request for information, receive, from the network resource, information that includes map content and vehicle related content associated with the location-based client, wherein the vehicle related content is based on the determined location of the mobile device;

in response to receipt the information from the network resource:

display the map content via a user interface of the mobile device; and

display the vehicle related content via the user interface of the mobile device concurrently with the map content.

16. The mobile device of claim **15**, wherein to display the vehicle related content via the user interface of the mobile device concurrently with the map content, the one or more processors are to:

present a map that indicates the location of the mobile device; and

in conjunction with presentation of the map that indicates the location of the mobile device, present an indication of the location of the mobile device and information on one or more vehicles that correspond to the location of the mobile device.

17. The mobile device of claim **15**, wherein to display the vehicle related content via the user interface of the mobile device concurrently with the map content, the one or more processors are to:

present a map that indicates the location of the mobile device; and

in conjunction with presentation of the map that indicates the location of the mobile device, present information on vehicle-related services that correspond to the location of the mobile device.

18. The mobile device of claim **17**, wherein to present information on vehicle-related services that correspond to the location of the mobile device, the one or more processors are to:

provide information on a route followed by a first vehicle; and

predict future locations of the first vehicle based on the route followed by the first vehicle.

19. The mobile device of claim **15**, wherein the one or more processors are to:

receive information including an update to the vehicle related content; and

display the update to the vehicle related content via the user interface of the mobile device concurrently with the map content.

20. The mobile device of claim **15**, wherein the one or more processors are to:

in response to display of the map content and the vehicle-related content:

receive a user input corresponding to the location-based client;

transmit the user input to the network resource, the user input shared by the network resource with a second mobile device; and

wherein to receive the user input, the one or more processors are to:

provide an input field associated with the location-based client; and

receive information provided to the mobile device through the input field.

21. The method of claim **1**, wherein displaying the vehicle related content via the user interface of the mobile device concurrently with the map content wherein the vehicle related content comprises displaying a recommended speed for the location of the mobile device.

22. The non-transitory computer-readable medium of claim **8**, wherein displaying the vehicle related content via the user interface of the mobile device concurrently with the map content comprises displaying a recommended speed for the location of the mobile device.

23. The mobile device of claim **15**, wherein to display the vehicle related content via the user interface of the mobile device concurrently with the map content, the one or more processors are to display a recommended speed for the location of the mobile device.

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